HARVARD UNIVERSITY.

LIBRARY

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY.

24,575.

Duplicate book exchange
June 9. 1906.

2nd edit

3rd edit

THE FIELD NATURALIST'S QUARTERLY

THE
FIELD NATURALIST'S QUARTERLY

A JOURNAL DEVOTED TO

ZOOLOGY IN ALL ITS BRANCHES, BOTANY, ARCHÆOLOGY,
FOLK-LORE, AND ALL SUBJECTS WORKED BY FIELD
NATURALIST AND KINDRED SOCIETIES

EDITED BY

GERALD LEIGHTON, M.D.

VOL. I.

WILLIAM BLACKWOOD AND SONS
EDINBURGH AND LONDON
MCMII

All Rights reserved

CONTENTS.

No. 1. FEBRUARY 1902.

PAGE
Editorial. With Full-Page Illustration by Frank Southgate . 1
Six Uncommon British Sea-Fish. With Full-Page Illustration.—By F. G. Aflalo, F.Z.S., F.R.G.S. 7
Bird-Song in Winter.—By Charles A. Witchell . . . 14
Reptile Studies: I. The Effect of Captivity on Character and Disposition. II. Hibernation.—By Gerald Leighton, M.D. . 17
A Note on the Breeding Season of the Dormouse.—By H. E. Forrest 23
Snails in Winter.—By Arthur E. Boycott 25
The Vivarium in Winter.—By Rev. Gregory C. Bateman . 35
Entomology in Winter.—By Claude Morley, F.E.S., &c. . 38
A Field Naturalist's Diary for 1901.—By W. Percival Westell, M.B.O.U. 41
The Fauna of New Zealand.—By Apteryx 44
Winter on the Norfolk Broads.—By Rev. M. C. H. Bird, M.A., M.B.O.U. 46
Records of Observation: Notes on Shropshire Fauna. Reptilia.—By H. E. Forrest 52
Marsh Botany in Winter.—By William A. Dutt 55
Telegony in Dogs.—By J. Cossar Ewart, M.D., F.R.S., University of Edinburgh 59
The Court of Claims and the Coronation: Notes on Cinque Ports.—By Rev. P. J. Oliver Minos, Ph.D., M.R.A.S. (Lond.) . 65
The Field Naturalist's Library 69
Field Clubs and Societies 72
Questions and Answers 75
Correspondence 75
Young Naturalist's Quarterly Competition 76
Notices 77

No. 2. MAY 1902.

Editorial. With Full-Page Illustration by Frank Southgate . 79
Butterfly-Hunting in the Alps.—By H. Rowland-Brown, M.A., F.E.S. 84
Some Spring Movements of Sea-Fish.—By F. G. Aflalo, F.Z.S., F.R.G.S. 99
Reptile Studies: III. Spring—The Season of Renewed Functional Activity.—By Gerald Leighton, M.D. 103
Entomology in Spring.—By Claude Morley, F.E.S., &c. . 107
Moles.—By Oxley Grabham, M.A., M.B.O.U. 111
Norfolk Broads in Spring. With Illustrations.—By Rev. M. C. H. Bird, M.A., M.B.O.U. 114
A Field Naturalist's Diary for 1901—*Continued.* With Illustrations. —By W. Percival Westell, M.B.O.U. 119
Spring Fungi.—By Carlton Rea, B.C.L., M.A., &c. . . 122
Marsh Botany in Spring.—By William A. Dutt . . . 126
Some Birds in Shakspear. The Raptores.—By J. L. Bevir, M.A. . 132
Animal Photography.—By Alfred Watkins 138
Norman Architecture—I.—By Rev. P. J. Oliver Minos, Ph.D., M.R.A.S. (Lond.) 143
The Field Naturalist's Library 148
Field Clubs and Societies 150
Correspondence 152
Answers to Correspondents 155
Young Naturalist's Quarterly Competition 156
Notices 157

No. 3. AUGUST 1902.

Editorial. With Full-Page Illustration by Frank Southgate . 159
The Establishment of an Arbor Day.—By Reginald Haines, M.A., M.B.O.U. 165
Feathers: Their Structure and Uses.—By Basil W. Martin, F.Z.S., M.B.O.U. 171
Reptile Studies: IV. Summer—The Season of Reproduction.— By Gerald Leighton, M.D. 177
Some Signs of Age and Sex in Fishes.—By F. G. Aflalo, F.Z.S., F.R.G.S. 182
A Note on the Angler-Fish.—By Sir Wm. Turner, K.C.B. . 185

Montagu's Harrier in North Wales (Illustrated).—By H. E. Forrest 186
The Dates of Arrival of Our Summer Migrants.—By W. Percival Westell, M.B.O.U. 189
Lives Measured by Minutes.—By Rev. John Isabel, F.E.S. . 196
The Gulls of Twigmore Warren (Illustrated).—By A. E. Johnson 199
Entomology in Summer.—By Claude Morley, F.E.S., &c. . 202
Bird-Life on the Broads: Summer.—By Rev. M. C. H. Bird, M.A., M.B.O.U. 205
Some Birds in Shakspear.—By J. L. Bevir, M.A. . . . 214
The Flowering of *Drosera rotundifolia*.—By James A. Greig . 221
Record Photography.—By Alfred Watkins 222
Norman Architecture—II.—By Rev. P. J. Oliver Minos, Ph.D., M.R.A.S. (Lond.) 226
The Field Naturalist's Library 230
Field Clubs and Societies 237
Correspondence 238
Answers to Correspondents 240
Young Naturalist's Quarterly Competition 241
Notices 242

No. 4. NOVEMBER 1902.

Editorials 245
Our Neglected Mammals.—By H. E. Forrest. 251
Folk-lore: I. Shagfoals.—By W. H. Bernard Saunders . . 255
Fishing Notes in South China (Illustrated).—By J. C. Kershaw, F.E.S. 258
Reptile Studies: V. The Adder-Swallowing Theory. VI. The Capacity of the Adder's Gullet (Illustrated).—By Gerald Leighton, M.D. 261
Some Autumn Wild Flowers.—By W. Percival Westell, M.B.O.U. 269
Norfolk Broads in Autumn.—By Rev. M. C. H. Bird, M.A., M.B.O.U. 272
Some Birds in Shakspear: The Corvidæ.—By J. L. Bevir, M.A. . 278
Entomology in Autumn.—By Claude Morley, F.E.S., &c. . 285
A Note on the Reproduction of the Slow-Worm (Illustrated).—By Rev. S. Cornish Watkins, B.A. 289
Fish Notes.—By F. G. Aflalo, F.Z.S., F.R.G.S. 291

An Extinct Butterfly (*Chrysophanus dispar*, Haw)—The Large Copper.—By J. R. CHARNLEY, F.E.S. 294
On the Occurrence of *Cotula coronopifolia* in Cheshire.—By E. M. WOOD, Liverpool Naturalists' Field Club . . . 300
Norman Architecture.—III.—By Rev. P. J. OLIVER MINOS, Ph.D., M.R.A.S. (Lond.) 301
Toothwort (*Lathræa squamaria*).—By JAMES GREIG . . 307
Some Deep-Sea Plunder (Illustrated).—By A. E. JOHNSON . 310
The Field Naturalist's Library 318
Field Clubs and Societies 323
Correspondence 325
Answers to Correspondents 330
Young Naturalist's Quarterly Competition 333
Notices 334

INDEX 337

MERCILESS YET MERCIFUL, A WINTER BIRD STUDY.

The Field Naturalist's Quarterly

VOL. I. FEBRUARY 1902. NO. I.

Editorial.

IN presenting this our first issue to our readers, it may be well to indicate briefly the object the Editor and his colleagues have in view. We intend in this journal to deal with all the subjects that are usually the objects of attention and study with members of Field Naturalist Clubs and kindred societies. Many such societies publish their own transactions at intervals, others do not; in any case, it is felt that a useful purpose may be served by a periodical which will indicate the work that is being done by students in different branches of natural science in various localities. The advanced student in Zoology, Archæology, Botany, and other special branches of knowledge, has in nearly every instance the choice of a journal devoted exclusively to his particular study, written by eminent specialists in their respective lines. Our own object is a somewhat different one from that served by such publications. Many field naturalists take a real interest in animals, plants, or the various objects of local interest in their neighbourhoods, who at the same time have not the opportunity or the desire to take up one special branch of study. Without wishing to know all that is knowable about anything, they still like to know something about many things. It is for this numerous class that we shall endeavour to make our pages instructive and interesting; and if, as the result of our efforts, some readers are induced to become specialists, something will have been gained to the cause of natural science, and they will find abundance of more advanced special material to encourage further study in one or other of the periodicals referred to above.

As its title indicates, this journal will be published quarterly, and it is our intention, as far as possible, to treat the various subjects from the point of view of the seasons. Thus, the articles on animals in the present issue deal more particularly with the winter condition of those species. It is hoped that this method will be of assistance to field-workers by indicating the direction in which they devote their attention to the best advantage. Out-of-door observations are obviously more attractive in the warmer months, when plant and animal alike are in their time of highest functional activity. Theoretical considerations and quiet study are perhaps more agreeable companions of the winter fireside. The cycle of the seasons has its counterpart in all animate nature—birth, development, maturity, and decay succeeding each other throughout; and the field naturalist who keeps this sequence continually before his mind, will find it far easier to "see life steadily and see it whole" than by simply assimilating a number of isolated facts without any evident cohesion.

Looked at in this way, the field of Biological work will be found to present successive problems for each season, though the opportunity of examining these problems will largely depend on whether the observer happens to live in a city or in the country. In the former case, the field naturalist will depend more on lectures and reading than outdoor work; while the country naturalist may investigate for himself the effect of winter on the fauna and flora of his own district. Thus, he will note the migrations of birds, the time of arrival and departure of winter visitors, the situations in which reptiles and bats pass their state of hibernation and the length of this period in different species, the effect of severe weather on animals and trees, and a host of suchlike questions. If careful notes be taken at the time the observations are made, and compared with those of successive years and other observers, a great deal of valuable work may be done, which, though it may not be new, is well worth finding out for oneself.

While not excluding general articles on objects of interest, we shall endeavour to colour the four quarterly issues of this journal in each year in such a tone that they will reflect the four seasons in succession. In other words, we shall have a Spring, Summer, Autumn, and Winter number in each year. The present number, as far as it refers to our fauna, is therefore a winter number; the April issue will be the spring number. The additional labour attached to bringing out the first number has somewhat delayed us this year, and next winter we shall probably publish the winter number in January.

There will naturally be more scope for illustrating the articles in the warmer seasons, and in our future issues we hope to show how the camera of the field naturalist has been at work. Both weather and light are against the photographer in winter, and, moreover, there is so much more to illustrate in the seasons of active animal and plant life.

It is of course quite impossible to treat of every subject of interest to field naturalists in one issue, so that new subjects will constantly be introduced. For instance, in our next number we shall publish the first of a series of articles on Archæology, an article on "Spring Fungi," and so on.

The success or failure of 'The Field Naturalist's Quarterly' depends upon the support accorded to it by those for whom it is written—viz., the members of our field clubs and societies. It was on the suggestion of a number of these members that the work was undertaken, and the Editor is very grateful to those secretaries of societies who have given such cordial help.

* * * * *

A most fascinating subject is that of "Animal Sense Perceptions," or in simpler language, how the world appears to the lower animals. That their conceptions of surrounding objects are identical with our own is an assumption which a little study of the comparative development of the organs of sensation in different species and orders will show to be quite unthinkable. A dog relies mainly on the sense of smell for purposes of recollection, a cat on hearing, a bird on sight. The total impression, therefore, formed by any animal of *its* world is probably very different from our impression of *its* world. The editor of the 'Zoologist,' in his recent paper on this subject in that journal,[1] has given his readers an intellectual treat which we would fain hope will be taken advantage of by every student and lover of animals. Those who have never given any thought to this aspect of animal life will be gratefully astonished at the much wider view of creation opened up to them by the thoughtful study of Mr Distant's articles, and the works to which he makes reference.

Another very delightful paper, which appeared in the 'Zoologist' for October, is that by Mr J. L. Bevir, on "Dante as a Naturalist." The paper has many quotations from the 'Inferno' in it, and the writer's comments are most interesting. We have often thought that a book entitled 'Zoology in Literature' would command a large audience, and after reading this and other notes of the same description from Mr Bevir's pen, it would be good news to know that he was engaged on such a task. We know of no one better qualified for it.

Mr Bevir is evidently of opinion that the adder takes to water freely in search of food, a point upon which we are somewhat doubtful, never having seen an adder either in water or in any position that would indicate such a habit. The ring snake, of course, passes much time in that element.

* * * * *

Field naturalists who are also breeders of cattle and horses will find much food for reflection in Professor Cossar Ewart's recent Presidential Address to the Zoological section of the British Association. Professor Ewart took for his subject "The Experimental Study of Variation" in animals, in connection with which he has made so many experiments during the last few years. After discussing age, ripeness of germ-cells, condition of the body, change of habitat, and intercrossing and interbreeding as causes of variation, he turned his attention to maternal impressions and telegony. Both these latter are believed by many to be causes of variation in offspring, but Professor Ewart's experiments give no support to either theory. He sums up the result of these experiments—ranging over hundreds of animals during the last six years—thus: "Not a particle of evidence have I found in support of the maternal-impression doctrine." This belief, which is held by some naturalists, a few physicians, and many horse-breeders, is of course associated with the shepherd who peeled wands and exhibited them to the ewes; and amongst the poorer rural classes it is almost universally held to-day. Every child that is born with a birth-mark or any deformity is at once accounted for by the mother having witnessed some peculiar or dreadful sight during her pregnancy—often long after the child must have been well advanced in development. It is a case of *post hoc*, therefore *propter hoc*, and a belief which will doubtless die hard.

---

[1] "Animal Sense Perceptions," W. L. Distant, the 'Zoologist,' September 1901.

Professor Cossar Ewart argues strongly also against telegony or infection being regarded as a cause of variation. "Telegony," he says, "means that not only the immediate parents, but also the previous mates (if any), contribute to the character of the offspring; that, *e.g.*, a mare which had produced foals to, say, Ladas and Persimmon, might thereafter give birth to a foal by Flying Fox, to which Ladas and Persimmon, as well as the actual sire, contributed some of their characteristics." This doctrine of infection has long been held by breeders, but in this case, too, Professor Cossar Ewart sums up: "The results of my experiments, not only with the Equidæ, but also with other domestic quadrupeds and birds, all point to the conclusion that there is no such thing as telegony; and the same conclusion has been independently arrived at by Baron de Parana in Brazil."

* * * * *

A research which may have very valuable results, and which seems certain to bring to light many new and interesting facts, is at present being undertaken by Dr George H. F. Nuttall of Cambridge. It has been found that the blood of certain animals, treated in a particular manner, gives a "reaction" different from that obtained with human blood. Starting from this fact, the object of the research is to find out whether every animal blood can thus be differentiated from human blood—a very important question from a medico-legal point of view. Besides this, as Dr Nuttall says, "it seems certain that interesting results, from the point of view of zoological classification, will thus be brought to light." One can very well imagine that the bloods of animals, could they all be treated in such a way as to give a reaction different from that obtained with human blood, would afford some striking evidence of affinities and distinctions at present unknown. Dr Nuttall has set himself the immense task of obtaining specimens of every vertebrate blood and some invertebrate, and the means adopted are so simple that every field naturalist can be of assistance if he wishes. Blood can be taken from dead animals up to twenty-four hours after death. The blood is simply soaked up on strips of pure filter-paper, one end of which is left clean in order to write the name of the species and collector upon it. The paper quickly dries, or can be placed between sheets of impervious paraffined paper. The whole apparatus can be carried in the pocket in an envelope, and the sportsman or person in the country who encounters dead animals in all sorts of ways can thus render valuable help. We have seen the outfit, and proved by experiment that it is no trouble at all, so would ask those of our readers who perhaps do not often have the opportunity to help in scientific zoological work to apply to Dr Nuttall for specimens of the filter-paper. (Address—Dr Nuttall, 3 Cranmer Road, Cambridge.) Those who number gamekeepers among their friends will find abundance of material in the "larders."

* * * * *

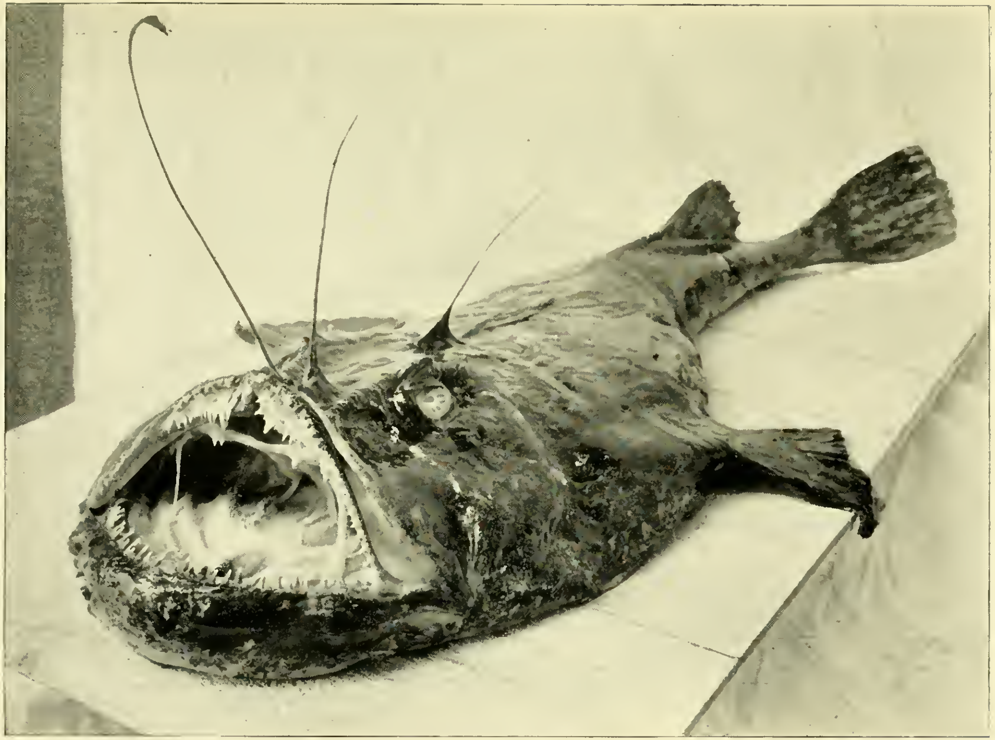
The seasonal bird study by our artist, Mr Frank Southgate, in this number, is the first of a series that he is doing for this journal. Along the coast of Norfolk, where gunners are in much evidence, it is no uncommon thing to encounter the remains of a meal, the carcass of some wild fowl picked clean by the crows. If one is fortunate, the whole proceedings may be seen: the fall of the wounded bird, the advent of a single crow, the gathering of his comrades, the slaying and quick dismemberment of the unfortunate victim, midst much quarrelling and croaking. Such a scene Mr Southgate had in view in this picture, the old crow standing over a wounded redshank, "Merciless yet merciful."

Six Uncommon British Sea-Fish.

By F. G. Aflalo, F.Z.S., F.R.G.S.

In selecting half a dozen "uncommon" British sea-fishes for passing notice in the opening number of 'The Field Naturalist's Quarterly,' regard has been had rather for that meaning of the word which denotes the possession of some remarkable or interesting character—something in the form or habits which lends itself to description for those interested in natural history. The mere fact of scarcity of appearance in British seas is, after all, of interest rather to the specialist in the geographical distribution of fishes. Our choice might, for instance, have fallen on one of the coral-fishes (*Holocanthus tricolor*), which has been once taken, near Stornoway, off our coasts; or on the Norway bullhead, also once trawled off the Mull of Kintyre; or, again, on the black pilot (*Pammelas perciformis*) and derbio (*Lichia glauca*), likewise taken once only within British territorial waters; but the very rarity of their occurrence only proclaims how very limited is our knowledge of their habits. Again, a fish may, in the literal sense, be common or the reverse according to the point of view. During a portion of the year the writer resides within easy reach of Plymouth, and pays frequent visits to the Barbican when the weekly trawlers are bringing in their spoils, and many fishes that would be exceedingly uncommon on the slab of London fish-shops, more suited as they are to the national museum than to the epicure's dinner-table, come in among the spoils of the sea—the *marée,* as the expressive French word has it,—so frequently at certain seasons as to attract no further attention. The six here chosen, then, on these grounds, are the angler-fish, the chimæra, monk-fish, torpedo, weever, and sun-fish, not one of which would ever find its way to the fishmonger's, save as a curiosity shown with a view to attracting possible customers for more agreeable wares. One or two shops in the west end of London are particularly famous for these monsters of the deep; and many a time the writer, whose friends know his eccentric fondness for such sights, has been rung up on the club telephone to go down Bond Street or to Charing Cross and inspect an unusually large angler or a brilliant opah, while even in Bournemouth there is a shop that makes a speciality of displaying trophies out of which not the most cunning *chef* in Paris could in all probability make a stew that would not offend the gorge of a Texan cowboy. The last exhibit of the kind in the Bournemouth shop was an immense angler-fish—the week before there were a trio, consisting of a spotted dog-fish trawled in the bay, flanked by a brace of monk-fish also taken from neighbouring waters—which weighed over seventy pounds, and which had the honour of being requisitioned for the national collection at South Kensington.

The Angler-fish (*Lophius piscatorius*), then, the first of our uncommon sextette, is the very type of what an angler should be—quiet, slow of movement, unobtrusive. It is not a beautiful fish, for its head, like that of the sperm-whale, must occupy a good third, if not more, of its total bulk, while the mouth suggests, when distended to its full capacity, nothing so much as the despairing legend in Dante. The exact extent to which the "angler" uses the rod-and-line arrangement, which is in reality a prolongation of the dorsal fin, is much disputed. Mr Cunningham, who has written much of our sea-fish, seems inclined to doubt its more constant use, particularly criticising the alleged phosphorescence of the "bait" at the end of the "line." A Bournemouth correspondent of the 'Daily Graphic' sent to that publication a very admirable sketch of the above-named



From a photo by Reinhold Thiele & Co.

THE ANGLER-FISH.

angler-fish—by the way, as the writer informed Professor Boulenger at South Kensington at the time, the specimen in question was trawled in the vicinity of Plymouth—but, unable to leave well alone, he added a description according to which it appeared that the fish lies in wait for its victims with jaws distended, as displayed at the fishmonger's, and the impetus of swimming fishes subsequently, by some marvellous and inscrutable process best known to the author of the statement, carried them within that gaping cavern. It must, however, be clear to any swimmer that such an account lacks correctness, for the angler is a monster of such sluggish deportment that the tiny fishes that form its meals would have ample time to back water and turn tail on that forbidding gullet before the disappointed giant had a chance of seizing them. No; the angler just lurks against a carefully chosen background of seaweed, jaws closed and rod in play, and as soon as a small fish comes along with its fatal curiosity to investigate the strange object dangling in the water, the mouth opens of a sudden, and the inrush of water impels the small fish to a closer acquaintance with the object of its research. Not at all times of life is the angler so sluggish in its movements, for in the larval stage—fishes go through metamorphoses, like insects, after leaving the egg, and in some cases the larval fish differs from the adult form no less than the caterpillar from the butterfly—it is a free and rapid swimmer. In the evening of its life, however, it is but a poor performer in mid water, though it can, with the aid of its hand-like pectoral fins (compare those in the gurnards), walk slowly on the bottom of the sea like a frog on the mud.

A very different manner of fish is the Rabbit-fish (*Chimæra monstrosa*) of northern seas, or "cat" of the Mediterranean, and not the least singular fact about it is this wide distribution in cold and comparatively hot seas. For the rest, this chimæra is in appearance not much less eccentric than the fabled combination of lion, goat, and dragon of the Greeks, and it lurks so persistently in the deepest waters, coming near the surface only at night, and to the shallows only to breed, that very little is known of its habits beyond the alleged fact—unsubstantiated, I believe, by autopsy—

of its great appetite for herrings, hence its name "king of the herrings." It is somewhat closely related to the sharks, having their cartilaginous frame and scaleless skin, but it differs from them in the poor equipment of teeth, as also in the curious filament over the snout, a development that takes the form of a great flap of skin in its southern cousin, the elephant-fish (*Callorhynchus*) of Antarctic seas. Its long whiplike tail, on the other hand, suggests affinities with the rays; and even the male's claspers, while obviously fulfilling the same function as those of the latter group, are curiously modified and divided in sections. On the whole, the rabbit-fish answers more literally to the description "uncommon" than any of the rest named in this article, and man's opportunities of further studying its peculiarities would seem to be as slight as his desire. To the systematic ichthyologist there is, of course, something fascinating in these rarities, but the field-naturalist will aspire rather to a fuller knowledge of the more important types that figure as economic factors in the fisheries, or at any rate in the pastime of sea-fishing.

With the Monk-fish (*Rhina squatina*) we come to the shark family, and, though outwardly so like a ray, it is really more closely allied to the sharks. Generally speaking, however, it may be regarded as a link between the two kindred groups of cartilaginous fishes, and this intermediate anatomical position even seems to be recognised in such of its popular names as "shark-ray" and "mongrel-skate." Other local names of the fish have reference to its supposed resemblance to a fiddle, a monk, and an angel — the last named having also struck those who named it in both French and German seas; and there is, according to the standpoint, something singularly cowl-like or wing-like in the arrangement of the fins about the flattened head. The eyes of the monk-fish are not conspicuous, but lie almost buried in the skin. More noticeable are some small skinny filaments just over the mouth, and it has been suggested that these act in a manner analogous to that of the angler's fishing-rod. Beyond, however, the fact of the obviously slow movements of the monk-fish necessitating some such provision for securing sufficient nourishment, there is no sound evidence that these filaments have any such function in the animal's economy. To touch briefly upon the leading characters of the fish, in addition to those already noticed, is merely to state the outward features of most sharks, such as the sexual claspers in the male, and in both sexes the breathing spiracles, the five gill-slits, the mouth beneath the head armed with several rows of conical teeth, the granulated, scaleless skin, the eye lacking indeed the nictitant membrane found in so many sharks, but capable of closing by a somewhat different process of which lack of space precludes any closer description. The monk-fish is also said to possess a sense of hearing and indeed rudimentary ears. In the reproduction of its young it follows the sharks and not the rays, which it outwardly resembles, for the eggs are hatched within the body and the young extruded alive. All the rays, on the other hand,—and, among sharks, those two spotted dogfish, the nurse-hound and row-hound,—deposit the curious oblong egg-cases which people pick up on the beaches after stormy weather and call "purses." The monk-fish illustrates what was said at the commencement of these notes as to the relative commonness or rarity of any species according to the standpoint. In parts of the coast the monk-fish is comparatively scarce, but at Teignmouth, on the other hand, the writer has seen several in the course of a week in May, brought ashore in the sand-eel (locally called "sprat") sean and left to rot on the beach.

The Torpedo (*Torpedo nobiliana*) is in its way the most interesting of the rays, though their more typical quadrilateral disc gives place in the present form to a more nearly round shape. The distinctive feature of the torpedo lies in its electric organs, situate, in the form of gelatinous cells, behind the head, one on each side of the body, and it is from their power of giving shocks that the animal derives its popular names of cramp-fish or numb-fish. Five feet or more in length and somewhat less than 100 lb. in weight may be regarded as the limits of growth in the torpedos of our seas, though there are many other species in the Mediterranean and elsewhere than the one here intended. Of all the methods adopted by fishes for securing their prey none is surely more singular than this electric discharge, sudden and paralysing, reducing to a state of helplessness large and swift fishes that the torpedo would be otherwise quite incapable of either catching or overcoming. Nature does not waste the talents that she has to distribute. The torpedo, it is true, stands alone among British fishes in this conspicuous electric power (though the late Matthias Dunn, of Mevagissey, most gifted of fish students, once told the writer that he suspected a measure of the same power in most of the rays), but the gift has to compensate it for weak teeth and slow-moving fins. The fierce, swift sharks need no such aid in the capture of their prey; and the flat-fish, as slow as most of their class, are able to lie unrecognisable half-buried in the sand, and suck in such worms and shrimps as approach too near their twisted mouths. The torpedo, however, requires substantial food, and indeed the use of its electric organs, almost superseding that of its rudimentary teeth, is evident from the fact of fishes as large as salmon of 4 lb. or 5 lb. having been taken whole, and apparently unscathed, from the inside of one of these rays. Many of the rays have some distinctive weapon of offence or defence: in the thornback and starry ray there are the curved spikes studding the back and fins; in the sting-ray and whip-ray there is the fearful saw-edged dagger in the tail. It seems improbable that such monsters can have many natural enemies; yet, however effective the dagger in the tail may be in securing food, one can hardly imagine a similar use for the spikes on the back. But there may, in the depths of the sea, be enemies even of the rays. It is all very well to congratulate ourselves on knowing all the fishes that dwell in comparatively shallow waters, but it must, in the first place, be remembered that even the rays may at certain seasons wander considerable distances from our coasts; and, for the rest, when we have to wait until the twentieth century for Sir Harry Johnstone to discover a new quadruped of considerable size in the jungle of Central Africa, who shall say what unknown monsters lurk, out of reach of hook or trawl, in the open sea?

Space is running out, and a very few words must suffice for the two remaining candidates for present notice.

Of the Lesser Weever (*Trachinus vipera*) the uncommonness is on some parts of the coast by no means so marked as could be wished, for this little scourge lurks, particularly after a spell of rough weather from the eastward, in every patch of sand within the "sphere of influence" of the shrimper's bare feet. Why the natives of the Hebrides should regard the lesser weever as the male of the sand-eel beats the understanding, yet such, though the writer cannot claim personal knowledge of that outlying archipelago, is said to be the current belief. The danger of this little fish lies in the sharp dorsal fin and opercular spines, which are capable of inflicting very severe and envenomed wounds, and the little pests lie in the sand, their eyes gazing upwards on the look out for something to hurt. They are much eaten abroad, the spines being removed before exposure for sale.

The Short Sunfish (*Orthagoriscus mola*) is comparatively common in summer weather in the extreme south-west of this island, and the writer has often seen its sail-like dorsal fin cleaving the still water just east of the Lizard. On one occasion, desiring if possible to secure a specimen for closer inspection, he inserted, with the aid of a Winchester rifle, a soft-nosed .303 bullet in the back of one that lay basking near his boat. To his intense surprise and to that of his boatman, who had cruised in those waters all his life, this immense living sphere leapt completely out of water, then, barely touching the surface, again, and yet a third time, recoiling on each occasion like a round stone thrown in the old water-side game of "ducks-and-drakes." Unfortunately the fish then sank out of sight, and, after sailing around the spot where we had last seen it for some minutes, we had to give up all hope of its recovery. Occasionally the sunfish takes a bait in those waters, and very large specimens, weighing 400 lb. or 500 lb., are from time to time entangled in the mackerel-nets. The French call it "moon-fish," and indeed it resembles the one heavenly body as much or as little as the other.

Such, then, are a few facts in connection with the organisation and daily life of these six fishes, and the reader who prefers a greater measure of romance must seek it from those pens that, in more commendable desire to please, are bound by no slavish regard for the facts as they are.

Bird-Song in Winter.

By Charles A. Witchell.

In winter, which may in an ornithological sense be considered as extending from the first day of November to the first of March, the singing of birds, like the blooming of flowers, is greatly dependent upon the clemency of the weather. If soft westerly breezes blow continuously at this season, the earliest plants begin to bud and bloom; and similarly the songs of birds—partly, perhaps, from the same cause—become more and more noticeable. There has been some conflict of opinion amongst observers as to the influence of weather upon the singing of birds—arising, doubtless, from a difference in the facts noticed. One may go out on a bitter day and hear five or six species in song; another on a similar day may notice none; and the result is, that while the former observer is convinced of the indifference of song-birds to the vagaries of our climate, the latter is equally determined that severe weather is fatal to bird-music. It is like the conflict of opinion between a lazy summer loafer who only listens to birds at noon or later, and an enthusiast who is up at dawn: each may be right in his deductions from what he has himself observed, and yet be diametrically opposed to the other. This, however, is certain: that though for a day or two after a spell of cold has commenced the birds may sing, a little more of it will silence all of them, except some lucky starling or robin for whom a kind human neighbour provides an unfailing supply of food. And, on the contrary, though the first warm day may not stimulate to song the birds that have been chilled and starved for a week or two, yet it is surprising how soon after the recurrence of active insect life around, music begins to flow from the satisfied birds. Of course in really severe weather even a well-fed robin is silent, and a plump starling only chatters occasionally; and after a long spell of cold it will be found that the hedge-robins in the country can hardly sing at all, and the starlings are much quieter than usual.

There is a class of naturalists who seem to think that a bird sings in heedless fulfilment of the tendencies of sex, in a somewhat analogous manner to the ticking of a clock when wound; and that the chill of mid-winter deadens this virile factor, and so puts an end to the vocal evidence of it. But this statement of the case slanders the enthusiasm and artistic intelligence of some of our singers—such, for instance, as the starling, who, long months before pairing, sings by the hour a greatly varied song, and practises new strains again and again, as though he enjoyed singing for its own sake and were proud of his song. He will do this when quite alone on the chimney-top as well as when his mate is near; and she, close beside him, may sometimes be heard as well as seen to join her feebler voice with his and prove that she too can sing. It is this winter-singing, with all its perseverance, wonderful mimicry, and attempted variation, so long before the nest is built, that raises the starling to a higher artistic plane than even that of the nightingale, whose triumph seems to be more immediately the result of temporary passion.

But we must not be thought to postpone the date of commencement of the starling's singing to the beginning of winter, for very many of the old birds return to the sites of their nests as early as the first days of August, at which time also the robin's song is resumed; and thenceforward on every fine day the songs of these birds may be heard. They do not begin with the full loud songs of September, October, and later; but throughout the remainder of the year gradually become louder and more vehement, with more perseverance and variety, suggesting in an obvious manner the course of evolution through which the songs of the species may in past ages have been developed. One or two well-known naturalists have sought to establish the theory of a distinguishable autumn song in these and some other species; but, after years of close observation of these same species, I am unable to find any evidence in support of such a distinction. It is especially desirable that such observation should be continuous, else will the gradual development appear as successive distinct stages in advance. One writer went so far as to allude to the robin and starling "striking up" in October or November—a term which seems lamentably inappropriate to these birds then. And the autumnal singing of a few chiffchaffs and willow-wrens (one or two per cent, perhaps), which may very probably be birds without offspring that year, can hardly be cited as evidence of the nature of the chorus of robins and starlings at that season.

Of hedge birds, the hardiest spring singer seems to be the hedge-sparrow, which will sing in a cold wind when even the robin and wren are silent. The wren is fairly fluent in winter, but, like the blackbird later, seems to prefer making a noise with call-notes or alarm-notes to singing. In extreme cold the nuthatch is perhaps the noisiest of our small birds. When skating I have often heard its full call, "twutt, twuttutt," at a time when even the blackbirds had been starved into silence. Possibly the violent exertions of the former bird, which drives its bill against the bark of a tree—and with the whole weight of its body—from five to seven times in a second, may tend to keep it warm and cheerful. Few small birds can peck so hard or so fast as this; and the vigour and rapidity thus displayed — doubtless long since gradually evolved from slower and less frenzied action—has its analogue in a loud and quick repetition of the bird's cry later in the season, or in spring. The blows may fall almost rapidly enough to cause a rattling; and the cry may be repeated a dozen or twenty times so quickly as to cause a sound like that of a railway guard's whistle, and almost as loud. As in most other birds, this greatest development of the song is not immediately attained; and it is equally entertaining and instructive towards the end of winter to notice the gradual extension of the "twuttutt" to the full length above indicated. And further, this note, after all, is not the bird's love-note (which is a soft squeak), but partakes in some measure of the artistic nature of the blackbird's song, though the art here displayed does not rise above the level of sheer unmodulated repetition.

Far different are the strains of those fluent winter singers the robin, thrush, and skylark, though the two last may be heard improving their songs daily—weather permitting. A few thrushes and larks were singing on the first warm days in October, but that was chiefly at sunrise or soon after; and later in the month, and in November, these songs became more noticeable. Rarer October songs are those of the chaffinch and cirl bunting; while the titmice, always noisy, are then occasionally heard giving some of their springtide cries or songs. Last October I heard a grey wagtail (*Motacilla melanope*) in full song whilst flying—a pleasant and varied warble, most unusual at that season. If the weather remained open, these October songs would doubtless be continued; but frost comes, and they cease.

Of all the sounds that tell of waning winter the blackbird's noisy clicking cry at evening is perhaps the most suggestive: it seems to make one realise, as surely as the delay of approaching dusk, that spring is really coming. But though then so noisy, the bird does not generally till February lift its voice in melody, and then, as we might naturally expect, its first songs are often short, and repeated again and again in the same notes, without that long and varied phrasing which ennobles its efforts in April, May, and June.

Reptile Studies.

By Gerald Leighton, M.D.

I. The Effect of Captivity on Character and Disposition.

The outdoor observation of our reptiles in the winter months must of necessity be limited to one phase of their existence—namely, the process of hibernation. But it is a convenient time for considering some general questions concerning these animals, of which the title of this article is one.

We are all rather apt to form our opinions of the habits and the character of animals from what we see exhibited by them in a state of captivity. The artificial nature of their surroundings, even under the most favourable conditions, is apt to be overlooked, or at any rate to have too little allowance made for it. There is a great risk of erroneous conclusions being arrived at by assuming that animals in captivity behave as they would in a state of wild nature. This applies to all wild animals more or less, but very much more to some than to others, and in a varying degree even in different species of the same order. Take, for example, the two most common serpents found in Great Britain—the venomous adder or viper, and the harmless ring snake or grass snake,—and note, in the first instance, the most prominent characteristics displayed by these two species in a state of nature. Then, secondly, observe how these same features in their respective dispositions are modified as the result of keeping them in captivity.

Undoubtedly the most prominent trait in the characters of these two species of snakes in nature is their desire to escape notice. The word "unobtrusive" describes better than any other term I know of, the adder in nature. Some slight difference is noticeable in the two sexes, the males being rather more active that the females, especially in the spring, but in both the same desire to elude observation is seen. In the heat of summer the females become lethargic to a degree, and will lie motionless for a couple of hours basking in the sun, perhaps asleep, at any rate oblivious to their surroundings unless disturbed, when they quietly glide into the nearest cover. This very absence of motion is their greatest protection, as the protective colouration possessed by them renders it difficult to see them at a little distance until they move. Thus it is that most cases of adder-bite occur from the person bitten being quite unaware of the proximity of the adder. I have captured a large number of adders, and I never knew one attempt to attack until escape was hopeless.

This same feature of timidity is still more marked in the ring snake or grass snake. Indeed the pace at which this species will glide away when disturbed is extraordinary, and often defies all efforts to follow. It is marvellous how this snake can hide itself in any green vegetation. It moves with much greater rapidity than does the adder, the indifference of the latter being replaced by active terror in the ring snake. If caught or nearly caught, the harmless species emits a most powerful and offensive odour, apparently its sole means of defence. Very frequently the presence of the snake is discovered by this odour before it is actually seen. The few points we have now noted will be sufficient for our present purpose of comparison of natural conditions with artificial ones, so we will presume that we have captured some specimens of both species, and that we have them in separate cages under observation.

Take the adder first. From the moment of capture this reptile becomes a different animal. Utterly untamable, the passive indifference is replaced by a most fiendish vindictiveness. As a rule — though of course more marked in some adders than in others — the mere approach of any person to the cage is sufficient to cause an active display of temper in the form of violent hissing and striking at the glass. Even though the adder sees but one person, toleration of the human presence is not established until the reptile becomes enfeebled, and I have in a cage at present an adder which has seen me several times a-day for some weeks—and no one else—which still hisses and strikes at me every time I approach. Thus while an adder in nature is a comparatively harmless reptile from its timidity, in captivity it is ever on the look-out to attack. More striking still is the refusal of the adder to take any food in captivity. The vast majority of adders in captivity starve themselves to death, and personally I have never had one that I could induce to feed. Mice, voles, and young slow-worms have all been tried in vain; sometimes the adder will kill the food offered to it, but rarely will it feed. It thus follows that adders are most uninteresting as well as very dangerous animals to keep in vivaria, and I cannot recommend them as pets to any one.

The harmless ring snake takes to life in a vivarium very soon, and is a delightful pet. After a week or so the unpleasant odour entirely disappears, and very soon also the great timidity exhibited in nature also vanishes. This species will soon learn to eat out of its master's hand, delights to take its bath in full view of the observer, and can be taught to come from one end of the cage to the other when whistled to or called by name. It will lie in the hand without the slightest sign of nervousness—indeed people are much more afraid of tame ring snakes than the snakes are of them,—appreciating the warmth supplied by the human circulation. In fact, in a short time the great fear shown in nature disappears almost entirely, the snake becoming truly domesticated.

What, then, is to be learnt from thus noting how captivity affects the character and disposition of these two reptiles? Obviously it indicates that observation of animals in captivity is not a safe guide to their natural habits. The case of the adder refusing to feed is an extreme illustration, for no one, I presume, would argue therefrom that it did not feed in a state of nature. So in regard to its alleged habit of swallowing the young for protection, the adder does not do so in captivity; but that is not a conclusive or even reliable argument that the process does not occur in the wild condition. It proves that it does not occur in captivity, nothing more.

By all means let us observe animals in captivity, but keep in mind that their behaviour may be different in their natural condition.

II. Hibernation.

In its simplest sense the word "hibernation" means, of course, merely to pass the winter; but as applied to certain sections of the animal world it has come to imply the passing of that season in a particular manner. But although we now use the term in a somewhat restricted sense, hibernation is, after all, only a particular example of one of the great laws of nature—namely, that of periodicity. Every living organism goes through a cycle of events comprised in the terms birth, growth, maintenance, and decay, and in the course of the whole period of its existence throughout those successive stages it has also its times of activity and its times of rest. The most obvious of these divisions is that which corresponds with the diurnal variations of day and night, light and darkness, and the highest animals, including man, arrange their lives accordingly. But a large number of mammals are nocturnal in their active habits, sleeping during the hours of daylight; this habit of life being necessitated on account of the persecution they suffer in the daytime, or from the fact that the food on which they depend for sustenance is only to be obtained in the hours of darkness. Most of these nocturnal mammals, or at any rate many of them, undergo a period of hibernation of shorter or longer extent, the length of the hibernation often varying with the severity of the winter, and being very different in some species from others. As far as mammals are concerned, the bats exhibit by far the deepest hibernation in this country: one of them, the serotine bat, retires for six months of the year, being seen but seldom before May, and disappearing again about the end of September. The other bats are also torpid for varying periods, being found hanging head downwards in caves, holes in trees, barns, and church steeples, according to the habitat of the individual species. It is said by some that the winter sleep of the shrews—also nocturnal mammals—is deeper than that of the bats, and certainly these little animals are very seldom aroused by any unusual warm weather which may come during the winter months. Badgers do not really hibernate, their sleep in winter being very broken, and never reaching true torpidity. Squirrels are to be seen in full activity during the most severe weather, though their appetite is not so voracious as in the summer months, and is largely supplied by accumulated stores of nuts and acorns laid up in advance. The dormouse, on the other hand, has a regular period of hibernation, generally retiring from active life in October; but if roused this species does not suffer the same ill effects as do the bats, interference with whose hibernation is often fatal. Warm sunny days will bring out the field-vole, only to sleep again when frost returns. But this torpidity of many of our smaller mammals is very different in degree and in character from that most remarkable physiological condition of true hibernation to be seen in the reptiles (we pass over the birds, as in them we have the phenomenon of migration replacing hibernation in those species which find the winter too severe to remain where they breed).

In both lizards and snakes there is a long period of torpor, but the time of the year at which this takes place depends on the country concerned. Thus in tropical and sub-tropical climes the reptiles retire in the hot dry season, to reappear when the rains begin. They thus do not hibernate but "æstivate." In a letter received from the Transvaal last November, from a lonely blockhouse, the writer says: "The rainy season having now commenced, we amuse ourselves snake-hunting for something to do." In colder climates, such as our own, both lizards and snakes disappear as a rule during the early part of October, and are not seen again until the following spring. During the whole of this period no food is taken, and the reptile lies to all outward appearance dead. The small common lizard gets to the bottom of a thick tussock of grass, the sand lizard burrows under the sand, and our third lizard, the slow-worm, is generally found under a heap of stones or leaves. The last species often congregates in numbers of from six to a dozen together to hibernate. This congregation is also to be observed in the adder and in the ring snake, large numbers of both species being turned out from rabbit-holes, old walls, and quarries, these being the usual sorts of places frequented. If roused artificially from their sleep, the result is commonly death, and it is generally believed that a bite from an adder at this season is comparatively harmless.

The observer will look in vain for any sign of life in a serpent thus hibernating. In my own cages out of doors I have this week closely examined both adders and ring-snakes, and failed absolutely to detect any sign of breathing or of the action of the heart. The serpent lies limp and helpless and very cold, to all appearance a lifeless thing. Yet two months hence or so the inanimate body will once more resume activity, and in the case of the venomous species will require considerably more careful handling. This reptile hibernation is a different thing from ordinary sleep. An adder will often be encountered asleep in the sun in summer, but in that condition it is in full physiological activity as regards digestion, respiration, circulation, and other processes: in the winter hibernation, however, all these are in abeyance, the reptile then exhibiting one of the most curious and wonderful examples of animal nature in adaptation to its environment that is to be found in the whole realm of organic life.

A Note on the Breeding Season of the Dormouse.

By H. E. Forrest.

The disputed question as to what is the precise time of the year when the dormouse has her litter is one which can only be answered by the field naturalist. It is truly astonishing that even at the present day very little is actually *known* concerning the reproduction of our smaller British mammals. As regards the dormouse, English zoologists all say that it breeds in the spring, whilst some suggest that it litters again in the autumn. Brehm, however, says that in Germany it litters in autumn. It is hardly conceivable that British dormice have a different habit in this matter from that of their Continental cousins. What, then, are we to believe? Whilst admitting that the species does perhaps litter both in spring and autumn, personally I rather incline to the belief that only one brood is reared, and that in autumn. In the coppices and hedgerows round my house the dormouse is rather numerous, and I have examined scores of nests, and have found, or have been shown, four litters of young, all in the autumn, the earliest of these being on August 28.

The nests are generally placed in a hedge, and fixed from 3 to 6 feet above the ground. They are almost invariably constructed of honeysuckle bark, the coarser strips being utilised for the outside, the finer shreds reserved for the interior, with dead leaves and sometimes moss, the latter doubtless added for warmth. This material would not be available in a sufficiently pliable state for nest-building except in the autumn. If the dormouse litters in the spring, then it must build a nest of some other material, for I am satisfied from the large number of empty nests encountered that the same nest is not used twice.

Furthermore, I have not found nests in this locality constructed of any other material than honeysuckle bark, thus showing their autumnal character. Another argument may be adduced from consideration of the life-history of the species. All dormice retire for their winter sleep about Christmas, rarely much before. They are then very fat. This winter sleep continues for almost three months, unless broken artificially or on account of unusually mild weather.

It is generally believed that the dormouse lays up a store of food for winter. This is probably the case, though I have failed to find any evidence of such stores. Certainly no such provision is ever found inside the nests. Mr G. Dumville Lees has, however, found nuts stored in holes in trees—placed there, he thinks, by dormice, as the holes were too small for squirrels to use. I have proved by experiment that the favourite food of the dormouse consists of acorns, and it appears to me that it would be difficult for dormice to obtain and store this food in the face of the great demand made upon it by wood-pigeons and pheasants. But this is by the way. During the long winter sleep the creature is sustained by its own accumulated body fat, and on emerging from this condition its first object probably is the search for food. Most likely the idea of perpetuating its species does not present itself until the animal has become "fully fed." Assuming, then, that dormice pair at the end of June, and that the period of gestation is about five weeks, the doe would litter in August. Of course some would pair later than others, the younger individuals later than the old ones. So it is not surprising that newly-born young are found as late as October.

I have never found two hibernating in one nest. At the present time I have two under observation in captivity, one an old buck, the other so young that it has not yet lost its juvenile brown colour which precedes the adult chestnut livery. Each was found in its own winter nest. This proves that even quite young dormice construct each a nest in which to hibernate.

It would be of great interest if field naturalists would record the dates on which they find any litters of dormice, especially if these should be in the spring, a point to which readers of this journal might turn their attention in the coming season.

Snails in Winter.

By Arthur E. Boycott.

It has often occurred to me that too many naturalists are apt to take the bad advice which is given in some of the books, and spend the winter in "looking over their collections." Such advice is bad in two ways, for not only are the dark days, with their frequent necessity for artificial light, quite the worst in which to examine specimens, but a study of the habits of an animal which is limited to its behaviour during the summer is altogether incomplete without a knowledge of its reaction in less propitious circumstances. For the sheer accumulation of specimens the conchologist will not, on the whole, find the winter a favourable time. This is perhaps a good thing, for it is well that a part of the delights of acquisition should sometimes be replaced by the less conclusive joys of meditation. And the "philosophical" conchologist, in whom our fathers so delighted, will find abundant occasion for his philosophy in a wintry day in the country.

Why is it that the snails which crawl about so freely in the autumn are only to be found after a frost in close nooks and crannies, often buried in the earth, and as a rule with some more or less substantial covering over the more exposed parts of their person—in short, bearing every appearance of trying to avoid the cold as much as possible? A certain number of human beings show a decided preference for staying by the fire under similar circumstances, but in the case of our snails it is not a case of choice, but of compulsion. In order that those processes of sensation, locomotion, and the like, which in the ordinary way constitute the more palpable evidences of vitality, may be duly carried out, a certain body temperature is necessary. Below a certain point (which we have reason to believe varies not a little with different species) the organism is unable to lead an active existence, though a still lower temperature is necessary to abolish the capacity of the now comparatively inert tissues to once more exhibit an obvious vitality with the return of more favourable conditions. It is indeed somewhat doubtful, as far as the lower organisms are concerned, whether a simple reduction of temperature, even far below zero, is adequate to destroy life apart from the mechanical injuries which are generally produced by the formation of ice. Animals such as mammals and birds can be active during cold weather, for they have acquired the power of combating external variations of temperature of a considerable range by appropriate alterations in the production and loss of heat in their own persons, and are thus enabled to maintain their body temperature at a convenient working level all the year round. Such invertebrates as snails no doubt possess this power in some small degree,—experiment shows that their bodies are a little cooler than the surroundings in hot weather, and a trifle warmer in winter; but the mechanism of this heat regulation, especially on the side of heat production, is far too poorly developed to enable them to do more than lag a few degrees behind the changes in general temperature in the direction of the mean coolness which is their optimum. So snails have to be quiet in winter and take what measures they can to protect themselves from the cold.

It is to be hoped that ignorance spares them any pangs of envy at the untasted delights which are enjoyed by such *Hyalinia* and others as have learned the trick of living in hothouses and similar places. Retirement into simple cracks in a wall or to any sheltered corner where the air is quiet, evades the cooling effect of a wind; if, as is most conspicuously done by the common brown garden-snail, *Cryptomphalus aspersus*, many congregate close together, a certain amount of warmth is collected for the common use of the mass by multiple (and taken singly, useless) contributions from each individual. One of the soundest plans seems to be that of burrowing a few inches into the ground, where they are safe from anything but the severest frost. Many genera have adopted this idea; perhaps the snails most often found are various *Hyalinia*.[1] There is, too, a simple way of obtaining what appears to be practically the same thing as this subterranean retreat—burrowing under stones which are in contact with the ground. So many snails habitually retire every day to such situations at all times of the year (presumably for the cool damp), that it affords a convenient winter resort. As a matter of fact, one generally finds that snails seem to have burrowed into the ground from under stones; but whether this is because we generally look for them in such places, or because they burrow from where they find themselves at the onset of cold weather, or because the surface layer of earth is frozen hard elsewhere, is a point that cannot be discussed here. I am not aware that the winter habits of such a subterranean species as the minute *Cæcilioides acicula* have been worked out; presumably it has none, since in its natural haunts (or what are currently believed to be such) there is little or no winter.

Since the power of increasing heat production under the stimulus of cold is practically absent in the Mollusca, the only way in which they can combat the winter is by decreasing their heat loss. The method by which, in all probability, a snail is liable to lose most heat is by evaporation from the free surface of its body. To escape this unnecessary loss the body is retracted within the shell, and thus an area is left exposed which is equal only to the aperture of the shell. Moreover, the surface is retracted below the edge of the mouth, whereby it is the less exposed to ventilation. And at least two more devices are often resorted to: the mouth is applied to some flat impervious surface and cemented on to this round its edge, and a diaphragm of this cement substance is thrown all across and entirely closes the aperture.[2]

---

[1] One occasionally finds in several species what appear to be attempts at making a sort of cocoon similar to that seen in the "shelled-slug" *Testacella*.

[2] I confess that I have never been able to satisfy myself of the actual existence of the "air-hole" in the epiphragm which is often stated to be present. The point, nucleus, or whatever it may be called, which is said to mark the site of this aperture, seems more likely to be the last point with which the foot was in contact, when the epiphragm was not yet of solid consistence. The epiphragm is apparently readily pervious to a slow exchange of gases and aqueous vapour over its whole extent.

This epiphragm varies in composition and consistency in different species: in the large "Roman snail," *Helix pomatia*, it is very thick and strong, containing a considerable quantity of inorganic material; and along the edge a reflection of the innermost part of the nacreous layer of the shell, of a partly silicious character, is said to be often formed. In *Cryptomphalus* it is tough and leathery, usually dirty white-brown in colour, but sometimes a beautiful pale-green. In most of the smaller species it is quite thin and fragile. The snail does not keep its body in contact with the inner surface of this membrane; it wisely interposes a layer of that warm material—stationary air. The epiphragm may be multiple; in one specimen of *C. aspersus* I have counted as many as seventeen which had been successively laid down as the snail had retired farther and farther within its shell. A few of our British snails have permanent doors to their shells: *Cyclostoma*, for instance, has a very thick operculum; and *Clausilia* a fairly strong clausium, which would appear to close the already much-reduced aperture quite tightly. It is, however, very often accompanied by an epiphragm.

Besides the actual cold, invertebrates have to make what provision they may against those assaults of more active animals to which the winter, with its period of enforced quiescence, renders them particularly liable. As far as snails are concerned, they are not in a much better position to escape such enemies as birds and mice under favourable meteorological conditions than during the winter. One of the leading German conchologists encourages the flagging spirits of the young collector with the remark that "snails are not accustomed to escape by swiftness." Indeed they are, as a rule, so much better hidden away during cold weather that it is only the scarcity of other food, and the consequently increased anxiety and energy on the part of the birds in searching them out, which renders winter not a more desirable time than summer. But it is probable that the enforced rest of winter may lay many of them open to fatal attacks by other invertebrate animals. Yet these are not numerously active at that time of the year, and the methods which are adopted to protect from the cold would in large part appear to be probably effective against the smaller animals. Be that as it may, there is no doubt that large numbers of snails perish during the winter, as any garden will show in the early spring, especially if the preceding winter has been severe. *C. aspersus* is particularly easily found to have thus suffered. Many of these show epiphragms intact, and seem to have died from stress of weather.

Every one is familiar with "thrush's stones." We notice them chiefly in winter, but they are very common all the year round. There is hardly any familiar wayside object which so forcibly brings before us such an important series of biological ideas. Only one can be mentioned here, and that very shortly. It concerns the origin of the warm-bloodedness of the higher animals. When we look at the battening thrush and the empty broken snail-shells, the advantage which the power of maintaining a high and constant temperature gives the bird is obvious. But the disadvantages are there too. To keep up this temperature a warm-blooded animal has to do an immense amount of work, both in procuring food and in transforming the energy of most of this food into heat. Some of the higher mammals are no doubt thankful for this necessity of taking so much to eat, but when abundant food is not to hand, the pains and penalties are not inconsiderable. Moreover, the warm-blooded animal is certainly in the position of greater danger. As a matter of fact, an increase in the complexity of structure and specialisation of function, with an associated greater tendency for death to ensue from slight injuries, happen to coincide in our zoological series with an elaborate power of heat-regulation. But apart from this, the organs have to work so hard that they are no doubt more liable to morbid changes which end in incapacity, and they have become so tuned to a high and constant temperature in which to do their work that, let that temperature be varied by but very few degrees, they will not only temporarily but permanently cease to discharge that complex of operations which we know as life. Subsequent results compel us to believe that our sauropsidan ancestor, who first discovered that he was able to so keep up his temperature that he could walk about in the frost and devour his torpid brethren at his leisure, found these lazy gastronomic delights enough to counterbalance the imminent danger of death which came with this new capacity.

Insects are a familiar group in which the stress of winter is tided over in the majority of cases by the assumption of a stage in their metamorphosis which is one of comparative rest, and which may conveniently persist as such, or become active to its completion with foul or fair conditions of weather. But snails are not well situated in this respect: their adult life is longer, and may commonly extend over several years, while, except in the egg (and here but imperfectly), there is no period of development in which the animal is well protected from external conditions, and which may be almost indefinitely prolonged under unfavourable circumstances. On the other hand, of course, the adults are capable of taking on a stage of comparative rest more readily than many other invertebrates. How far any species of snails pass the winter in the egg stage cannot, in the present state of our knowledge, be properly estimated. I have on many occasions been struck by the frequency with which one finds three common species (*Tachea* and *Limnæa peregra*) pairing in the second half of September and the first half of October. When the eggs are thereafter deposited I have not been able to find out. I have no certain recollection of finding eggs of *L. peregra* (the common spired pond snail) as late as the middle of October. It is possible that in these and other species the winter is passed in the egg.

All individuals of a species of snail do not exhibit the same reaction towards cold weather. In many species the young do not hibernate to nearly the same extent as the adults. A very marked example of this is found in *C. aspersus*. Why this should be so it is impossible to say; owing to their smaller size the young actually have a relatively larger surface to be exposed to the cold than the full-grown animal, and the area of the aperture is not relatively smaller. Perhaps, after all, the temerity of youth and its immunity from many ills of the flesh must pass for an explanation here, as in the precisely similar phenomenon exhibited in ourselves. Observation certainly leads one to believe that relatively fewer young than old snails die during a hard winter "from natural causes" or from cold; but the very important task of constructing a Registrar-General's Report for the lower animals has as yet hardly attracted sufficient attention, and the data remain to be collected.

All species do not exhibit the same reaction to cold weather. When we are full of certain knowledge on the matter, this portion of our subject should be one of very great interest. At present we know so little that most of our thoughts are the merest statements of ignorance. Different species may, and presumably do, differ from one another in (1) their power of heat regulation, and (2) the body temperature at which they are able to lead an active life. How far the former consideration is to be taken into account, it rests with an untouched field of experimental investigation to tell us in an exact way. It is also only along the lines of exact research that we can hope to discover what part the different factors play in determining the habits of each species. In the present state of our ignorance it may be permissible to speculate a little. In the first place, the colours of the species may have some influence. Snails with dark-coloured shells would *prima facie* seem less well fitted to withstand exposure to cold than similar species of lighter colours, in which heat radiation should be reduced by the pallor of their surface tints. The observation that *Xerophila virgata* does not hibernate is an old one, and it is not altogether true. This and other species of the white-and-black group included in our English *Xerophila* may show well-marked periods of hibernation. On the other hand, there is no doubt that these species—especially perhaps *X. virgata* and *X. caperata*—frequently manifest a degree of resistance to the cold which is remarkable. On the whole, it is more probable that their pale colouration is correlated with a life spent in exposed situations under the rays of a hot sun, rather than with any particular power of enduring frost. It must be borne in mind, however, that the bare commons and similar localities which this group especially affect, while perhaps very hot during the daytime, are liable to be very cold at night.

The varying habits of different species may also be referred to their chorographical ancestral history. The snail fauna of England is made up of many different groups, some of which are characteristic of, and reach their highest development in, warm climates; while others are a part of more northerly fauna. Representatives of the former clan might be expected to exhibit a prolonged period of hibernation in a climate such as ours. This is actually the case. *Cryptomphalus*, with its brightly variegated browns and yellows, and the darkly-striped red and yellow shells of *Tachea*, may be taken as characteristic examples of the southern forms, and it is in these species that we find hibernation most marked and most prolonged. This is especially seen in *C. aspersus*, which seems to retire for the winter rather according to the time of the year than the temperature of the particular autumn. The middle of a warm wet September will sometimes find this species in winter quarters, from which perhaps it will not emerge until the following March or April. I once tried to thoroughly wake up some specimens in midwinter, but no allurements in the way of warmth, wetness, or food, had any effect. *Tachea* behaves in much the same way, though its period of rest is, as a rule, somewhat shorter, and it is more liable to be tempted out by warm rain in midwinter. In marked contrast with such species as the foregoing is such a one as *Vitrina pellucida*, with its fragile pale-green shell. One finds that *Vitrina* is not only willing to walk about in cold weather, but actually seems to prefer to do so. I have seen the dead leaves of the woods and hedgebanks swarming with this almost shell-less mollusc while skating was being indulged in, and it was freezing hard. *Vitrina* is an essentially boreal species, and shows its contempt for our English attempts at frost, while the long and marked æstivation in which it indulges is presumably indicative of disgust at our tropical summer. For such southern forms as *Tachea* our summer is not hot enough, and they do not, as a rule, æstivate in this country, or at any rate not to anything like the same degree as is their custom in, *e.g.*, Southern France. *Cyclostoma elegans* is our representative species of a great tropical group, and it hibernates in a marked way. Curiously enough, it also preserves in this country the habit of æstivating, and in the height of summer is often to be found buried quite deep in the earth. How little the texture of the shell is able to compensate for old tribal feelings and habits is well shown in the species I have mentioned. *Cryptomphalus*, *Tachea*, and especially *Cyclostoma*, all have thick shells, and the last named has a stout operculum as well; while *Vitrina* has the thinnest of shells, which, as a rule, only covers a portion of its person. One of the most attenuated coverings among English snails is that of a species, *Fruticicola fusca*, which has acquired some fame for its boldness in frosty weather.

Space forbids of more than a brief consideration of some of the points which are suggested by the behaviour of our aquatic species in winter. The two factors which have probably been chiefly instrumental in keeping the population of our fresh-water system within such meagre limits are the rapidity of the efferent currents to the sea, and the variations of temperature to which small bodies of water are subject, with their attendant dangers of dessication on the one hand and freezing on the other. Were it not for that most convenient property of water which results in an ice-film being first formed on the surface, animal life in many ponds would in all likelihood be reduced almost to nothing. Records are abundantly present in the literature of the subject showing that snails may be frozen in a solid mass of ice for days or even weeks, and yet recover and live when liberated by a thaw. Whether in these cases the body of the animal has been actually permeated by an ice mass is, I think, somewhat doubtful. That soft tissues could endure the cutting and disruptive effects of the formation of a mass of ice crystals without suffering some permanent damage seems improbable; and in a good many cases it has been shown that animals so enclosed in a block of ice are in reality immediately surrounded by a narrow liquid zone. The difficulty in believing that complete freezing may be followed by *permanent* recovery, lies not so much in the low temperature as in the mechanical conditions to which the animal is subjected.

Many of our water snails bury themselves in the mud at the bottom during cold weather; but one can usually find a fair number in a lethargic state moving about in the upper portions of the pond. It is said that the almost amphibious *Succinea elegans* hibernates in the mud as well as under stones and amongst rubbish on land. Whether any of the species of *Limnæa* deliberately leave the water to hibernate I do not know, but the sub-terrestrial *L. truncatula* I have found in winter alive in the soil some distance above the level of the water. After all, it should be remembered that aquatic species, though exposed for long periods to quite a low temperature, are not subjected to those intense frosts which the terrestrial forms have to combat.

A large number of our fresh-water forms usually obtain the oxygen necessary for their existence by coming to the surface and taking in atmospheric air. A good deal of question has been raised at one time or another as to how such species survive when the free surface of the water is covered, it may be for weeks together, with a thick and impermeable coating of ice. But there are two considerations which seem to remove most of the difficulties in the matter. In the first place, the degree of metabolism, and consequently the amount of oxygen required, is very much reduced with a reduction of external temperature. It has been shown, for example, that growth does not take place in *L. stagnalis* unless the water be almost warm. It is also known that the number and duration of the excursions which the flat pond-snail, *Planorbis*, takes to the surface to fill its pulmonary sac, vary directly with the temperature. As a reverse experiment, it is easy to demonstrate that in hot summer weather *L. peregra* will not live more than four or five days if kept in a small body of water and prevented from reaching a free surface. In the second place, there is no doubt that pulmonate aquatic mollusca can under some circumstances obtain an efficient supply of oxygen from the gas dissolved in the water through the walls of their air-sacs, and also most probably through their general cutaneous surface. Such a mode of respiration seems to be the normal habit of life with the abyssmal *Limnæa* from the deep Swiss lakes; and it would indeed be surprising if we found that the pulmonary sac in these snails can alone conduct a proper exchange of gases, when animals as high in the vertebrate scale as Amphibia (and with a lung far more highly differentiated and specialised than any similar organ in *Limnæa*) effect at least the major part of their respiration through their general skin surface.

We have thus seen that even in the invertebrate kingdom the arrangements provided by nature for the passing of the season of winter are comparable to the hibernations of the vertebrate animals; and if in the Mollusca the conditions offer more scope for investigation, they are not the less interesting on that account.

The Vivarium in Winter.

By Rev. GREGORY C. BATEMAN.

IT goes without saying that the inmates of a vivarium should be allowed to follow the promptings of nature to spend the cold weather in a state of torpor. Hibernation, therefore, on the part of these captive animals ought to be encouraged and provided for, as far as possible, by their owner.

Some of the reptiles, if they have fed well during the summer months, and are in really good condition in the autumn, may be taken out of their cases and packed away in suitable winter quarters where the temperature will be low and the creatures themselves quite out of the reach of frost. They should be surrounded with dry moss, and then put into strong wooden boxes out of which they cannot escape.

Tortoises, moderately-sized snakes, and certain lizards can be thus treated. The larger snakes should be carefully watched. If they lie in an almost dormant state, and show no signs of having colds or of getting unduly thin, they ought to be left alone, care, however, being taken that the air of their cases be maintained at such a temperature that this condition of things may be continued throughout the winter.

When it is seen that a snake has taken cold the temperature ought to be raised to about 75° or 80° Fahr., and, if possible, the reptile should be induced to feed.

Sometimes it happens that snakes, especially the larger ones, though getting much too thin, cannot be persuaded to eat in spite of the high temperature of their dens. Under such circumstances, rather than run the risk of death through weakness, the animal should be fed against its will. This is fairly easy to manage, and may be thus accomplished. A number of dead mice or young rats is obtained and dipped in new milk (warmed). Then the operator should take the snake by the neck and body, and, having seated himself upon a low stool, allow the greater portion of the reptile to rest on the floor. If the snake be tame it will probably not even struggle while its mouth is gently opened by means of a paper-knife. As soon as its jaws are wide apart an assistant is ready to place one of the dead rodents inside, with the head towards the reptile's throat, down which it is carefully and deftly forced, a smooth short stick being used as a ramrod. When the mouse or rat is past the throat it may be easily worked down towards the stomach by the manipulation of the fingers outside the snake's body. Enough dead rats and mice for a good meal should be administered at one time in this way.

Frequently when a snake has been thus treated, as soon as it has digested its involuntary meal it will recommence to feed freely of its own accord. However, if this does not happen, the "stuffing," as it is called, should be repeated at the end of ten days.

When a snake is large and savage and needs "stuffing," it should be first placed in a suitably-sized strong bag. It is a simple matter to bag even a big snake in the right way, but a very difficult one to accomplish in the wrong. The proper method is to turn the bag inside out, and place the right hand and arm within the reversed bag and take with the former, thus protected against a bite, the snake by or near the neck, and as the reptile is lifted up or removed from its case the bag naturally falls down the right side out over a portion of the snake's body, and then the assistant has simply to take the mouth of the bag with both of his hands and gently shake the rest of the animal into the bag, which may be tied before the neck of the snake is released by the hand now holding it on the outside of the bag. And when the compulsory meal is to be administered it is only necessary to allow that portion of the reptile's body out of the bag which is required for the purpose.

The keeper of snakes should always have at his disposal several bags, of various sizes, strongly made of swan's-down, and he will find them useful, not only for artificially feeding some of his captives, but also for confining them safely and warmly when their dens are being cleaned or rearranged.

If preferred, instead of "stuffing" it, a thin snake can be induced to drink milk. This is generally easily done, as most snakes, when unwilling to feed, are from time to time quite ready to drink. Milk-and-water, half and half, is put in place of the clean soft water which should always be present in the den. Every day the milk and water are renewed, and the vessel which contains them scalded. The milk, thus taken, may be sufficient to prevent the snake from getting too thin during the time it refuses to feed. Sometimes snakes will go without food for a whole year, and yet apparently be little the worse for their long fast.

Young snakes should always be tempted to eat as much as possible during their first winter; but their second winter, if they are well-nourished and quite healthy, ought to be passed in a state of torpor.

Most of the lizards, and many of the small snakes, may be allowed to hide themselves out of sight in some of the places of retirement which are generally provided for them in their cases; but the temperature of these cases should always be kept several degrees above freezing-point. It will be found that on fine and mild days during winter the lizards, and perhaps the snakes, will come forward to bask in the rays of the sun, and occasionally to feed.

The frogs, toads, and other Batrachians may also be allowed to stow themselves away in their own cases: some will bury themselves in the earth, and others will hide under bark, cork, or moss; and thus most of them, if not all, will pass the winter in safety.

Such lizards as the chameleon should always be kept in a heated cage in winter-time, and be tempted to feed as much as possible on cockroaches and meal-worms.

Entomology in Winter.

By Claude Morley, F.E.S., &c.

In these days of agricultural depression, when the making of fortunes is in the city and the losing of them stalks throughout the provinces, the country is, more than ever before in the history of mankind, regarded as a mere playground in which to exercise our skill in stirrup, rod, gun, or golf-club; and it is only through sheer force of modern thought that its more obscure denizens come to receive keener attention than they obtained at a time of greater familiarity. In Nature's heyday gorgeous butterflies career throughout our lanes and forests, soft-winged moths describe grotesque gyrations around our apartments, great dragonflies flash their wings before the fisher's eye, or an animated gem darts gleaming across the path we tread, to call forth the prosaic " How lovely ! " but to receive no second thought from us.

Few persons, consequently, ask themselves, when the dun days of autumn cast the sombre shadow of their lowering sky athwart the world, " Where are these things gone ? " Are they ephemeral as poesy would have them, do they indeed die in half an hour ; and how then is the race propagated during the long months when no bright creature is seen in the length and breadth of a long day's journey ?

Millions truly perish, but winter does not kill them. The first keen blast warns them that their time draws near indeed, and instinct prompts them to hasten the deposition of their eggs ; and when this task is done their *Ultima Thule* is attained, and life has no more use for them than if they had oviposited in May—for those whom Nature ordains shall complete their mission in May, die in May, as surely as their later brethren, fulfilling theirs, die in October.

And these eggs, deposited with more than human care and perspicacity, what becomes of them ? Snugly ensconced in some nook or sheltered cranny, they lie pacified by the rigour of the season till the genial warmth of balmier days causes their protoplasm to circulate, and then they shortly hatch.

But other millions of earth's pigmy race do not so perish: many lovely butterflies hide themselves away in hollow trees, outhouses, and even in our very bedrooms—a King George has sat unmoved within my own since last September. Wasps, beetles, moths, frog-hoppers, as well as humble-bees and ants, all squeeze themselves away among the roots of grass, the bark of prostrate trees, in faggot-stacks, and just wherever they know that King Frost cannot find them. And so when you traverse a desolate and empty wintry waste of country, bemoaning the bright fairies which erstwhile peopled every flower and grass-blade, lo! they are yet with and around you, but each snugly tucked away within its torpid nest, dreaming out the horrid days, with vitality at lowest ebb and respiration just sufficient to sustain the creature in a living state, yet with no undue waste of tissue, till back the blood courses through the veins next spring.

As the train whirls me on to York through brown pastures, where the snow lies deep beneath the hedgerows, I know that under snow and ice and winter fog there lie the legions of earth's atoms, defying in a wondrous way the worst that frost can do. A caterpillar may be frozen so stiffly that to all appearance it is dead, and so brittle that a slight bend will halve it between your fingers like a twig; but left alone, it will survive and show no symptoms of degeneration in the spring. Some chrysalides lie for weeks in solid blocks of ice down in the water-meadows, proving to the full that oxygen forms no great factor in the physiology of their quiescent state; and moths and beetles have often been found, at least in the Hartz Mountains, crawling upon the level plains of snow.

The sloth of entomologists in winter has ever been a source of wonder to me. True, there is not the number and variety of insects to be found that there is in summer-time, but at this season some will be obtained that will then be sought in vain. Now you see them in their natural habitat, and often little clusters or colonies of some rare kind are met with, which on the wing are seen only singly or in pairs.

The opinion long obtained that no particular selection of a hibernaculum was made, but from my own observations I am inclined to consider this too sweeping a statement.

The very grass and herbage we so heedlessly pace are most affected by all kinds of insects, because therein they find greater cover than elsewhere; and of these plants the best beloved is the tuft grass called *Cæspitosa*. This choice is a proof of the instinct of insects. The roots of this weed are stouter than those of the usual meadow grass, and so constitute a better breastwork to shield them from roaming moles and birds; they are also less closely placed than the roots of rushes, which grow so thick and stout that to force a passage through them would be lost labour, since so great a quantity of dampness is exhaled by these Junci that their inhabitants would be prone to die of that most fatal of insect winter scourges — mildew. Mildew destroys far more of them than frost, snow, voles, or parasites, and so it is that following a mild, damp winter far fewer insects are abroad than after a season of hard cold and ice.

When searching tufts of grass it is no very easy matter to dislodge their occupants, and two good ways of proceeding may be mentioned. The first, and generally most useful, is to cut the tuft off low down and shake the gathered bunch above a paper or an umbrella, piece by piece. In this way crowds of spiders, woodlice, centipedes, and other loathsome vermin will drop out, as well as the more desirable quarry sought. The second method is to pull the roots up bodily and cast them into an adjacent pond or stream. Bubbles rise, and with them our little friends, who, feeling air again, at once strike out straightly for the nearest shore or raft, their knowledge of that most easily attainable being wondrous to behold. In a limited locality, however, this especial kind of tuft is looked upon with jealousy, as affording greater prizes than all others, and it is well not to destroy the roots which will in the second year have put forth a new young forest of sheltering shoots.

The *débris* lying scattered about the base of hay-stacks, and bracken stacks in woods and on the moor, yields most unlooked-for prizes, which are best obtained, since often of minutest size, by carrying the *débris* home in linen bags and searching carefully through it on the study table. The great, hard fungi seen high up on trees should also be retained and placed in glass jars, whence will issue, with no further trouble on the part of the collector, various small brown beetles, with two- and four-winged flies in May.

But even now all nature is not still. The inhabitants of our ponds and streams will swim about in chilly water, seeming to take less heed of temperature than their terrestrial brothers. Often you may stand upon your skates upon a shallow mere and watch the water-boatmen jerk along beneath the ice ; and long before the sun gains power the water-net should be at work amid the reedy ditches where water-beetles, bugs,[1] and flies are already issuing to begin the great onslaught of vegetation which will not cease till frosty nights bid them seek another winter's sleep.

A Field Naturalist's Diary for 1901.

By W. Percival Westell, M.B.O.U.

The object of the following notes is to point out what the ordinary observer of wild life may look for during the first three months of the year, by drawing attention to what was observed in the corresponding period of last year. Every field naturalist should keep such a diary, and he will find the comparison of his annual observations on animals and plants full of interest.

To many my notes may appear trifling and trivial ; but I am a humble follower of Richard Jefferies, in that I do not like change. I prefer to roam round the same old loved spots ; to watch each successive season the unfolding of even common flowers or the first green leaf; to listen for the first notes of the well-known migrants; to watch for the first butterfly on the wing. Rare records interest me but little; I prefer to pay attention to the various common, yet beautiful, natural history objects which present themselves as each month rolls by, and note the dates when the first flower opened, the first birds tuned their lutes, the butterflies first toyed in the air, and other notes of a like nature. One never tires of noting these records year by year; interest is awakened and stimulated by so doing, and, like Richard Jefferies, I too am content to listen to "the coloured yellow-hammer sing, sing, singing, so long as there is light to cast a shadow on the dial."

---

[1] May I be permitted to put what I hope is not a personal matter before our readers? The word "Bug" is used here, and should be used everywhere, in neither its extremely limited and unsavoury English, nor in its far too wide and vague American, sense. The "Bugs" constitute the entomological order Hemiptera, having a suctorial mouth and four sub-chitinous wings, of which the anterior are usually more or less membraneous. The first section of them, the Heteroptera, are cursorial ; the second section, the Homoptera or frog-hoppers, are saltatorial.—C. M.

January.—The first month of the year is usually a somewhat dull one to the field naturalist, excepting for the occurrence of any rare visitors. During the period under review I noticed with pleasure several small flocks of golden plover, and the shrill but monotonous notes of the meadow-pipit (which I cannot ascertain is hereabouts in the summer) were quite a feature of the bird-life astir. The flocks of starlings, too, are very conspicuous at this season, and the lapwings were never more welcome. On the 20th of the month the skylark, which had been silent since December 16th, resumed its song. In 1900 it resumed on the 24th. The missel thrush, too, sang during the month; and the visits of the blue, coal, and great titmice to the garden are always in evidence in January. On 27th, in spite of a hard frost, I noticed slugs harbouring under stones in the garden; and on the same date the honeysuckle was fast unrolling, spurring one on for the fresh green flush of spring.

February.—On the 1st the ring-doves suddenly became noisy, as also did several of the titmice. The robin, hedge-sparrow, and wren were singing gaily, and the lark, suspended in mid-heaven, was in rapturous song. Visiting Woburn Sands (Beds) to-day, I noticed the heather in flower, observed the beautiful green sheen on the bilberry and broom; and the hard frost seemed to have put new life into the now busy rooks and carrion-crows.

17*th*.—Biting cold. I heard a great tit utter the note of the chiff chaff, part of the redbreast's song, and the call of the nuthatch—this last so realistically as to bring one of these birds to the mimic. The rhododendrons were well budded, and the furze in flower; the moles had been busy "casting up"; the beautiful red buds on the young branches of the lime prominent; the activity of the screaming jays and the nuthatch, and the timidity of the ring-dove, attracted notice.

21*st*.—I heard the chaffinch singing for the first time; noted the earliest snowdrop. The air was full of the delicate song of the lark.

24*th*.—Many gnats were out.

25*th*.—Again heard the chaffinch. The hedge-sparrow is now in much fuller song.

28*th*.—The song thrush singing.

March 3*rd*.—Cold, but sunny. The yellow bunting first heard singing. The female blossom of the nut hazel first noticed out. Four or five woodcocks have been shot during this winter in a wood within a few hundred yards of my house.

5*th*.—Robin, song thrush, and skylark singing at 6.15 P.M.

10*th*.—At 4.30 A.M. rooks were passing over, cawing loudly; at 5.45 A.M. the skylark singing and soaring. The rooks busy at the nesting-trees; great tit very noisy. Crocuses out in a blaze of splendour; primroses in flower in the garden. Hedge-sparrow's and blackbird's nests found. Germander speedwell in flower.

12*th*.—Earthworms lying out at night; house flies about.

17*th*.—Temperature between 70° and 80° in the sun. Summer heat! The singing of the blackbird makes a welcome addition to the birds already in song. The lapwings are in pairs in the same old loved spots. Jackdaws are prominent. Lesser celandine, chickweed, dog's mercury, green hellebore, and sallow in flower. In the woods the primroses are some in bud and some in flower. Found several blackbirds' and song thrushes' nests ready for eggs. Bluebottle-fly seen. Saw what I took to be a white wagtail at the bottom of my garden; it did not seem so lively as the pied species, and I noted the black head, throat, and upper breast, with a white collar on either side of the black; white neck and sides of head, dark grey back, grey wings (with very pronounced white at the edges), whitish under the breast.

19*th.*—Very heavy snowstorms. Birds mostly silent all day.

20*th.*—Saw a goldfinch on a thistle-head.

24*th.*—Found song thrush's nest with two eggs. This bird was singing at 7 P.M. Saw a hawfinch which had been picked up on a railway bank, killed by telegraph wires.

25*th.*—Blinding snowstorm, but blackbird singing in spite of same.

31*st.*—Bright and warm. Cuckoo pint becoming prominent. Buntings paired. Elder and honeysuckle quite green; cowslips appearing. Watched the rooks dibbing and eating worms, the satisfactory gobble being very interesting to watch.

March 1901 was notorious for the changeable character of the weather. We had summer heat and blinding snowstorms; cold, dry, cutting winds; blinding snow in brilliant sunshine; soft summer weather; rain, hail, and sleet! Throughout all this the skylark never ceased to sing. On most days, too, the blackbird, robin, chaffinch, hedge-sparrow, missel and song thrushes, have all been singing gaily.

Note.—These observations refer to the district of St Albans, Herts, unless otherwise stated.

(*To be continued in our next.*)

The Fauna of New Zealand.

By APTERYX.

OCEANIC islands very frequently possess a fauna peculiar to themselves, and New Zealand is a striking example of this. The geographical distribution of animals depends mainly on two factors—viz., (*a*) causes tending to restrain species within their original faunal limits; and (*b*) causes assisting to diffuse them from those original faunal limits. The first class, or the barriers to the spread of species, are chiefly to be found in ocean and mountain barriers, and in the influence of climate. The second class, or the means of dispersal of species, are such factors as the seasonal changes producing migrations, ocean currents, trade winds, great rivers, and, in past times, geological changes. As the result of such influences as just mentioned, the fauna of New Zealand is peculiar to itself, and the only point in this brief note is to draw the attention of the student of animals to those peculiarities.

First as regards Mammals. These are conspicuous by their absence, being represented by a solitary rat; and it is even doubted whether this is a truly indigenous species, or a descendant of some taken to the colony in the ships of the earliest European visitors.

Taking the Birds next in order, a very different state of affairs is found to obtain. There are no less than sixty-nine families of land birds, fifty-eight of which are not found elsewhere. These include about twenty species of the so-called wingless birds, "surviving relatives of that feathered giraffe, the extinct Moa" (Aflalo). The raptorial birds are not prominent, probably because there are no small mammals to provide food. Very curious is the fact that the strong flying birds of Australia do not cross to New Zealand, more than half the birds of that continent being found nowhere else. True there is a matter of some twelve hundred miles of water between the two places, but one would have expected a much larger interchanging of birds than actually occurs. Thus one of the Australian swifts, which flies at a great altitude, and which has been credited with being able to perform the feat of crossing Bass' Straits, a distance of a hundred miles, in an hour, nevertheless never is known to visit New Zealand.

Coming now to the Reptiles, another remarkable feature of the fauna is to be noted, namely, the entire absence of serpents, at any rate as far as the species which dwell on the land are concerned. Australia, on the other hand, has more than one hundred varieties. This immunity from venomous serpents is found in islands in both hemispheres, Ireland being another case in point. But venomous sea snakes are found off the coasts of New Zealand, viviparous reptiles which bring forth their young in the water. Perhaps the most remarkable of all the curiosities of the fauna is the presence of the lizard called *Sphenodon*, inasmuch as this reptile is the only living example of an otherwise extinct order. This rare lizard, somewhat more simple in its structure than the lizards of other orders, has a row of spines along the back, giving it a resemblance to an iguana. It reaches a length of about 30 inches. Moreover, it is the only reptile which shows the commencing spiral arrangement of the cochlea of the ear: in other reptiles, as in the birds, this is a simple cavity. Its nearest relatives are to be found in fossil forms. There are a good many other lizards in New Zealand which belong to existing orders.

It would be beyond the scope of this brief note to enter into any detail concerning the Invertebrates; but it may be just mentioned that there are comparatively few butterflies in New Zealand, and only one venomous spider, the native name for which, if the writer recollects rightly, means "the devil."

To sum up the most obvious features of this island fauna, we see practically an absence of mammals, no land snakes, a curious form of lizard allied to fossil forms, and a large number of birds to be found nowhere else. At the present day most British animals have been introduced, in the case of the rabbit with disastrous results. It is a fauna full of fascinating problems to the naturalist student.

Winter on the Norfolk Broads.

By Rev. M. C. H. Bird, M.A., M.B.O.U.

"The appalling dreariness and windy bleakness during the winter months would be more than I could bear"—thus wrote a lady friend the other day when thankfully refusing to hire a furnished cottage on the edge of Hickling Broad. "Wind-swept Hickling" this far-famed sheet of clear and shallow water has been aptly termed, but the extensive reed-beds and acres of rank vegetation growing in and upon the swamps and marshes adjoining its walls afford at all times and seasons plenty of quiet resting-places for feathered visitors. Nevertheless, to all but naturalists and sportsmen the windiness and dreariness of the locality may oftentimes from November to March be justly described as "appalling." On sunless days without a breath of wind, the solemn stillness of dead calm upon the then black waters would be quite sufficient to frighten away any solitary stranger who had previously been accustomed to the traffic of the Strand, or educated up to depend upon the company of others for amusement or interest. Here, more perhaps even than upon the wild wave-beat shore of adjacent Horsey, the veriest hermit, if town-bred, would feel the justice of Cowper's restrictions on Bruyère's idea of retirement, and whilst echoing the "passing sweetness of solitude," add with hearty fervour—

> " . . . grant me still a friend in my retreat,
> Whom I may whisper, solitude is sweet,"—

that is, unless the visitor were a very confirmed misogynist, or contented to fraternise with nature pure and simple. Once to my certain knowledge an enthusiast in pike-fishing and an authority on Coleoptera found a day on the broads too long. He was my guest, and anxious to combine jack-fishing with beetle-hunting. The morning was dull and cloudy but still, and I thought that my groom-gardener would be able to move a boat quite quickly enough for my friend to fish, whilst I went apart with my gun. Wild-fowling is, perhaps, from the silence necessary to success, the most selfish of all sports, and I must confess that after spending an hour or two with the water-net, hunting for "bugs," I congratulated myself on getting off alone, for there were many duck about, and my fingers were itching to be off after them, instead of dabbling amongst mud and rotten weeds for small things with big names and great powers of concealment. About mid-day the wind freshened, and by three o'clock it blew nearly a gale from the south-west, bringing with it great pellets of rain which were quite unpleasant to face. Looking round for my friend with the aid of my binoculars, I spotted him about a mile away to leeward, sitting bolt upright, mackintosh-clad, and immovable, whilst my man, unskilled in matters aquatic, but strong and willing as the proverbial horse, was vainly attempting to make headway against the storm. He was eventually obliged to let the boat drift ashore on what fortunately happened to be a good landing-place, for had they been blown into the reeds—only ten or a dozen yards on either side of them—there they would have been compelled to remain till helped out.

A curious, and to me inexplicable, effect is caused by the action of the wind on these waters. The waves running in front of the wind are crossed at right angles with streaks of white bubbles, and these ribbon-like streaks of foam stretch quite across the broad at intervals of about 4 feet. Sometimes for days after the wind has ceased the accumulated froth lumps up white upon the farther shore, and by strangers might easily be mistaken at a distance for drifts of snow, or the conspicuous feathers of a flock of white-breasted sea-gulls. Hundreds of these birds frequently come here to slake their thirst, generally alighting in the middle of the broad and not round the edges, little of the shore being free from reeds or rushes. The uninitiated may wonder at the idea of beetle-hunting in winter, but many of the water-beetles, and good things too, may be taken whilst the surface of the ditches in which they reside is covered with ice. By the month of March aquatic Coleoptera are both numerous and active, and, moreover, more easily found than at a later time of the year, when the weeds have made fresh growth. The early nesting of the wild duck is thus justified, for here in these beetles is a natural supply of food ready for the young.

Let me attempt to shortly describe a winter's day on Hickling Broad, when the climatic conditions were very different. It is ten o'clock in the morning, the air crisp and still, the sun brightly shining, the broad strongly laid by the intense frost of last night; the stems of the reeds stand upright, whipped clean of their leaves and picturesque blossom plumes by the wintry weather of the past few weeks; the remaining stalks are dried to a much paler brown than they were a week ago. The sea in the distance has "lost the wind," and the moaning it makes in consequence is conveyed to our ears by the whisper which remains of yesterday's north-easter. A score or more of boats, and men ready to shove them, mostly clad in guernsey and crotch boots, line the bank—for to-day is the annual coot-shoot. Not half the invited gunners turn up, thinking, no doubt, that it will be impossible to get at the birds which are now congregated in a large "wake" or open piece of water at the farther end of the broad, which, however, is not connected with either of the arms of the still unfrozen Y-shaped channel which spans the broad. Those shooters who have arrived are not keen to return home without having killed something; the boatmen, too, are all anxious to earn a trifle, for the cold snap has stopped their usual marsh-work. Consequently the ever-obliging keeper, Alfred Nudd, volunteers, with his copper-nosed punt and trusty quant, to break a roadway for us into the channel. This, of course, takes time, but eventually the boats, ten in number, are able to slowly follow him in single file. They distribute themselves at about equal distances apart in the roadway, channel, and open patches of water communicating therewith, whilst Nudd shoves on ahead to put up the coots. On this occasion only about 150 are slain, and after lunch we give up the pursuit. In spite of the bright sunshine which prevails, so intense is the frost that two or three birds which have fallen on the ice and been lying there for about half an hour are frozen stiff when picked up, a thing which had I not seen I should scarcely have believed possible.

A few words now concerning the coots on Hickling Broad, their manners, and the method of shooting them. Hickling, besides being the largest of all the broads, and, with the exceptions of Horsey and Somerton, the nearest to the sea, is also, in spite of its shallowness, the last to become frostbound. Hence in severe frost the coots from all the neighbouring smaller broads assemble before the accumulating ice compels them to resort *en masse* to Breydon mudflats and the sea. It is very interesting to notice how tenaciously they will cling to the very last piece of open water, sometimes sitting at the edge of it until the tail feathers are frozen to the encroaching ice. I have, in fact, shot some which were thus curtailed in rising, the birds being otherwise in excellent condition. So loth were they to leave the "wake" on the day just described that our forerunner, who was unable to approach within a hundred yards or so of where the majority of coots were congregated, took off his coat and hoisted it flag-like upon the top of his quant, and halloed in vain to frighten up the whole assembly. The most cunning and crafty refused to stir. Coots will not, when they rise, leave the water, whether it be open or frozen, but fly straight back over it and alight again at the other end, rather than go inland or make a circuit round the shore. Taking advantage of this habit, supposing that there is a bunch of coots at the south end of the broad, the gunners approach them from the north, with their boats lined up in crescent formation some 40 or 60 yards apart, according to the number of craft. This movement drives the coots towards the land, and this they refuse to face, the result being that the birds fly back over the heads of the gunners, thus affording capital rocketing and difficult shots. Although their pace may not equal that of the lordly pheasant, their feathers and down are more dense and their skin far more tough. Moreover, the rapid vibration of their short and rounded wings is very deceptive, and they appear to be moving far more rapidly than is actually the case. The shooting is all done sitting still, and the cross seat of a boat is somewhat in the way of the legs whilst swinging round for a side or cross shot; hence the introduction of the revolving seat, like a music-stool, instead of the straight plank. Then, again, the boat is never absolutely still, and to try and resist the motion of the boat whilst shooting is as fatal to the aim as is the effort to counteract the vibration of a train to caligraphy. Success in both performances is a matter of time, patience, and practice.

Coots are expert divers, and when wounded always make for the reed-beds, just as all pricked wildfowl hug the shore. It takes a good retriever to find a winged Frenchman in a ten-acre turnip field, but the dog has yet to be bred which will with certainty retrieve a wounded fowl from a half-acre reed-bush. In fact, few of the old marshmen gunners and flight-shooters of the broads were in the habit of using a dog at all. What birds they failed to kill outright or find at once they looked for round the shore next morning; and I know one or two such men now whom I would rather have to help me in hunting for a partially-disabled duck than the best dog I ever saw. If the water is not too deep, the reed is often too thick and the old reed stumps too sharp for the dog's feet, however eager and keen to work; whilst the marshman—accomplished in the art, with his store of accumulated knowledge and experience of the habits of fowl under such circumstances, and with eyes and ears ever on the alert to catch sight or sound or movement of reed or water, and with quant pole ever ready to strike the hiding quarry—seldom fails to mark and bring it to bag. Marvellous powers of sight and hearing the native broadsmen have, able as they are in the dark to differentiate the flighting duck by the wing sound, and to distinguish several species by the sound of the splash on rising from the water.

A curious natural phenomenon to which these wide, exposed, and shallow waters particularly lend themselves is the formation of ground-ice, or mare's ice, during a stock frost when the weather is severe, the wind high, and the temperature of the whole body of water below freezing-point. The waves keep the surface from consolidating, ice is formed at the bottom, rises, and drifts away with the wind, and we have the unusual spectacle of the broad freezing up to wind'ard. I have felt the bottom of a running ditch quite hard with ice, and seen the ice in the broad bring up with it large pieces of weed. But this is not what causes the round bare patches, conspicuous from their yellow-whiteness, in the midst of the otherwise weed-covered bottom. These are caused by the opposite extreme of temperature. When the waters are low and the summer sun very hot, the weed rises to the surface in lumps, is scorched by the sun, and in consequence dies and eventually rots away. Now the chief water weed here is a species of *chara*, and my botanist friend, Mr G. H. Harris, very reasonably suggests that as the *chara* is a great collector of lime, the whiteness of these spots is due to the deposit of lime left by the decaying *chara*.

Without experience of the occurrence, one would hardly credit the rapidity with which the ice on the broad breaks up, nor the noise which it makes in doing so if there be a wind. I have helped to shove a boat across the broad on the top of the ice in the morning, laid in a "wake" for fowl all day, and at nightfall come back in open water, a sudden rapid thaw with wind and rain having set in meanwhile. The great sheets of ice running before the wind crashed against and then drifted under or over one another, their accumulated weight striking against the steam-driven posts, knocking these far out of the perpendicular. It was just the day for wild-fowling, and we started with high anticipations; but the unexpected as often happens in sport as in other things, and we gained but little reward for our risks of exposure and hard work. My note-books bear witness to the fact that almost invariably when I have expected most sport then I have had least success in number, variety, or rarity, in the bag; whilst on the other hand, my red-letter days—few and far between, I own—in five and twenty years' experience have generally come when least expected. The glorious uncertainty of finding a rare plant, securing an uncommon insect, landing a heavy fish, or killing cleanly when one snaps trigger at a bolting bunny, adds considerable zest to the pursuit of collecting specimens, whether for the cuisine or the cabinet.

Records of Observation.

NOTES ON SHROPSHIRE FAUNA.

By H. E. FORREST.

THE recent floods on the Severn and its tributaries led to some curious results. The otters' "holts" in the neighbourhood of Cressage were submerged, and their tenants driven forth into the light of day. One took refuge in a pigstye in Ironbridge, where it was found and killed by a terrier. Another was seen floating about in a backwater on the carcase of a drowned calf. It is also probably due to the floods just before, that a party of salmon passed up the brook at Cound, to spawn there in a small stream where salmon have never previously been seen. A spent male fish of about ten pounds weight was seen lying dead in the brook on January 19th, and others subsequently.

During the weeks of December and January there have been immense numbers of wood-pigeons in the Shrewsbury neighbourhood — a foreign horde, smaller and darker in colour than our own native breed. On the evening of January 22, weather very mild, I saw a pipestrelle bat flying about. The winter sleep of this species is not so profound as that of some others.

As regards Shropshire, the year 1901 might be called the "Cirl Bunting Year," for never before has that interesting species been so much in evidence. Mr J. Palmer found two nests near Ludlow, and one near Bridgenorth. Mr A. R. Horwood saw the birds and found the nest at Marrington on the border of Montgomeryshire. Mr Rosse Butterfield saw a pair of cirls with their fledged brood near Oswestry, whilst in the preceding winter Rev. J. B. Meredith noticed birds at Kinnerly in the same district.

A White Wagtail took up its quarters about a mile from my house, and I had the pleasure of seeing it almost daily throughout the summer. This solitary bird is the only example I ever saw in Shropshire.

A Dipper is reported by Mr J. Palmer of Ludlow as having eggs in the nest in February (1901). This pair of birds reared *four broods* in the season. The nest was near a waterfall between two artificial ponds.

The following birds recorded in the county during 1901 are all very rare locally.

Feb. 13.—Female Smew, Betton Pool, Shrewsbury.

March 6.—Old male Cormorant, in full breeding dress, shot at Criggion. Cormorants frequently occur, but I never before saw one here in this plumage—white pencils on the head and downy tufts on flanks.

May 18.—Red-footed falcon, immature female; shot near

Shrewsbury; third county record. Stomach contained remains of Common Shrew and elytra of beetle.

June 27.—Hobby nested for third year in succession in old crow's nest near Ludlow; three fresh eggs on this date.

Sept. 18.—Black Tern, immature, shot near Broseley.

Sept. 23.—Great Snipe shot near Minsterley.

Sept. 24.—Chough caught in a pole trap at Church Stretton. Only one previous record in Shropshire.

Sept. 28.—Black-tailed Godwit found on the Stiperstones in a weak state, and killed. This species is far rarer than the Bar-tailed Godwit, and has not been obtained since Eyton's time. The specimen is a bird of the previous year.

Nov. 19.—Adult female Goosander shot on Betton Pool.

Nov. 21.—Near Shrewsbury I saw a female Hen Harrier flying across westwards about mid-day. Eleven days previously one was shot at Bromfield.

REPTILIA.

"When in the Cotswolds in June 1901 I killed a magnificent viper. It was the longest I ever saw, and I find on comparing the measurement with the records in 'British Serpents' that it is of unusual length. It measured $28\frac{8}{10}$ inches, and was a female. The ovaries were, however, very slightly developed. The stomach contained nothing but a slimy substance.

"I have also had a viper sent to me from near Whitchurch, which came in a bottle with a wooden plug in it. The viper reached me alive, but *en route* had disgorged a mouse of some kind, which I have not yet examined for identification."—R. Newstead, Grosvenor Museum, Chester.

(The first case noted by Mr Newstead is one of the very few authenticated instances of adders measuring over 28 inches. It is possible that the ovaries were atrophied from age. The second note is an example of a common habit of both adders and ring snakes—viz., disgorging any recent meal when captured.—ED.)

"I saw a specimen of *T. natrix* (grass snake) here two days ago. True it was rather sleepy, but not sufficiently so to allow of my capturing it. The date—October 21—is rather late for this species to be about."—C. M. Rogers, Wellington College, Berks.

"I observed specimens of the pipestrelle bat flying in the lanes of the Monnow Valley, South Herefordshire, on January 21 and 22 this year. In both cases the bats came out of ivy-covered trees in which they had been hibernating. Both these evenings were mild and warm."—T. H.

Marsh Botany in Winter.

By William A. Dutt.

Any one who ventures on to the Norfolk marshlands in winter—say towards the end of January or the beginning of February—does well to provide himself not only with windproof garments but also with waterproof boots. A week or two ago when I traversed a considerable portion of those widespreading levels, on which I have spent so many delightful spring, summer, and autumn days, I found many acres under water. It was not that there had been very heavy rains,—January had been a fairly dry month,—but a strong westerly wind had swelled the sea tides which came flooding up the Broadland rivers, filling them so full that the pump-mills had been unable to discharge the surplus water which drained down from the uplands into the marsh dykes. So before I had rambled far from the muddy "walls" which serve as highways across the marshes, I had cause to congratulate myself upon being provided with boots that a reed-cutter or a dyke-drawer need not have despised.

Even on a dull winter day there is plenty of colour on our Norfolk marshes; but on this particular day there were fitful sun-gleams, which flashed on the snipe-haunted pools and seemed to set the ruddy sedge-blades on fire. There were grass-marshes, which at a distance appeared as green as in spring-time—greener, indeed, for then they wear a pink flush of cuckoo-flowers or are veiled by a golden haze of buttercups; rush-marshes tawny as an autumn heathland; swampy marshes yellow with withered stalks and bleaching blades; and beyond them, like a field of ripe corn, was the glorious amber of the river-side reeds.

Over many of these marshes I had often rambled when they were pink, purple, and golden with summer flowers; but seen when the sunlight broke upon them through the driving clouds of a January day, they had all the hectic beauty of the heathlands in autumn, as well as a glory all their own.

But a botanist is never content with revelling in the wealth of colour which a landscape, taken as a whole, displays. So it was not long before I found myself noting that, though the sedge-blades were rusted and the stain of what Jefferies calls "sun-wine" was gone out of the withered dock-leaves, the leaves of the marsh bedstraws—we have both of them, *Galium palustre* and *G. uliginosum*, on our Norfolk marshes —were still as green as in summer. So, too, were those of the ground ivy on the "walls." But it was in the dykes that the brightest green was to be seen, for there the water-cress and the water-parsnep were showing new leaves; and those of the featherfoil or water-violet (*Hottonia palustris*), that lovely aquatic flower of a genus containing only two species, made matted masses of feathery foliage just below the surface of the water. Presently I noticed that the burdocks, which by the country roadsides had lost their burrs through being brushed against by foot-passengers and cattle, had here kept them, and seemed likely to do so till summer came again. By the dyke-sides and on the swampy marshes, sapless stems, topped with large brown star-shaped umbels, were the skeletons of last year's angelicas; while smaller stars were the involucres which once held the blue flowerets of the devil's-bit (*Scabiosa succisa*), that late-blooming scabious with a curious root, concerning which it was formerly believed that "the divell, for the envie that he beareth to mankind, bit it off at the root, because it would else be good for many uses."

Bordering a spongy marsh, where in summer the sundews are starred all over the moss which grows over the peat, I found a dyke almost choked with water-soldiers (*Stratiotes aloides*). The water-soldier, which, as its scientific name implies, is not unlike an aloe in appearance, is a characteristic fen-plant, fairly plentiful in our marsh dykes and shallow broads. It is one of the most interesting of the genuine Hydrophytes—*i.e.*, water plants—which, unlike some of the duckweeds and water-crowfoots, cannot exist for any length of time out of water. All through the winter it lies at the bottom of the dykes, to all appearances as dead as its neighbouring sedges and water-plantains; but when spring comes it rises to the surface, produces fresh leaves, and subsequently flowers resembling those of the frog-bit. When it has done flowering it sinks again; but towards the end of summer, when the buds are produced, it rises a second time and floats until the shoots which connect the young plants with it have rotted, when the latter become detached and, with the parent plant, sink to the bottom and remain there through the winter. So the water-soldier may be said to hibernate, as do those strange insectivorous water-plants the bladderworts (*Utricularia*). To some extent this remark applies to the duckweed; but it is not correct, as is often stated, that at the approach of winter all the duckweeds sink to the bottom of ponds and ditches over whose surface they have spread a "green mantle" during the summer months. In the course of my ramble I found the surface of several dykes coated with these minute plants. On investigation they proved to be *Lemna minor* and *L. polyrrhiza*, perhaps our commonest species. The ivy-leaved duckweed (*L. trisulca*), however, which is almost equally common in the marsh dykes, nearly everywhere had sunk to the bottom. The duckweeds are plants which almost every one would say are wholly amphibious; but those of our British species which have roots —that is to say, all of them except *L. arrhiza*—are capable of maintaining themselves, at least for a time, should the pond or ditch in which they grow "dry up." Their slender hair-like roots, which usually absorb nutriment from the water, attach themselves to the mud, from which they obtain food-stuffs until the pond or ditch fills with water again. Water, however, is absolutely essential, not only to Hydrophytes but to land plants, and should it be too long denied the plants will die. In regard to the duckweeds I may add, that it has always seemed to me that it is not alone the setting in of cold weather that causes these plants to sink. Often they remain on the surface of the water in frosty weather, and are frozen up in the ice.

This suggests a question not easily answered—*i.e.*, how is it that some plants are able to resist severe cold, whilst others are "nipped off," as the gardeners say, often by a single night's frost? This is a matter on which I do not feel competent to offer an opinion; but while I write I have before me some interesting notes contributed by Mr F. J. Mott, F.R.G.S., to an old number of 'The Midland Naturalist.' From these notes it appears that the capacity to resist frost may be due to several causes, either singly or in combination. Amongst them are—

1. The proportion of water to solid matter in the cellular tissue.
2. The chemical constitution of the solid matter and the cell sap, which varies slightly in different species.
3. The proportion of foliage to roots, and stomata to leaf surface.
4. The more or less dense structure of the epidermal tissue.

Plants, Mr Mott adds, are killed by frost, not so much on account of the rupture of their tissues in consequence of the expansion of the water into ice, as was formerly believed, "but rather through the structural and chemical changes which take place in consequence of the normal proportion of water being removed from the cell walls, the cell sap, and the protoplasm." In the course of some further remarks he draws attention to the fact that the sap of some plants freezes at a lower temperature than that of others. It is almost impossible, he says, to freeze a moss. This explains how it is that some plants survive being "frozen up" in ice. Several years have passed since Mr Mott gave Midland botanists the benefit of his inquiries into this interesting subject. Many readers of 'The Field Naturalist's Quarterly' would, I have no doubt, be glad to know whether he has now anything else to tell them about it.

Winter on the marshes is not without its signs of coming spring. True, the catkins of the rugged alders and silvery birches in the "carrs," as the marshfolk call the copses, had not begun to lengthen; but every marsh was studded with prickly stars, from the midst of which the tall stems of the handsome marsh-thistle (*Cnicus palustris*) would appear, and along the river-walls the cleavers were sending up little shoots like Chinese pagodas in miniature. On a heap of rotting dyke-drawings some chickweed bore a few tiny white flowers amid the green leaves of the sorrel dock, dove's-foot crane's-bill, and small nettle. (It was just by this heap, to which some plants alien to the marshes had strayed, that I found in the autumn a giant puff-ball (*Lycoperdon giganteum*), as big as my head.) A delightful surprise, too, awaited me when I came to a marsh near which some marshmen were cutting reeds and carrying them away on their wide flat-bottomed rafts. Glancing over a boggy tract which I had often visited when the beautiful buckbeans were flowering, I saw a patch of bright yellow in the midst of the dark rushes and ruddy sedge. There was no mistaking it. On the 27th January, before the first coltsfoot had pushed its way up through the clods on the river-walls, and when I could not so much as find a single daisy, there was the marsh marigold in bloom. Gilbert White gives March 20 as the first flowering date of this plant, yet there it was, on a open marsh exposed to the keen winds from off the North Sea, blooming nearly two months before its time!

Telegony in Dogs.

By J. Cossar Ewart, M.D., F.R.S., University of Edinburgh.

The crude philosophic theories of the eighteenth century gradually gave place during the nineteenth to theories largely based on observation and experiment, with the result that we are now all saying the "age of science" has come and that the "scientific spirit is the spirit of the age." Though it is doubtless true the methods of to-day differ decidedly from the haphazard methods of former generations, it is also true that many of our beliefs are still reminiscent of the middle ages. This becomes especially evident when the views commonly held in regard to vital phenomena are taken into consideration.

We, as a rule, still cling to the doctrine of "the transmission of acquired characters"; like the patriarchs of old, we think the offspring are liable to be definitely influenced by "maternal impressions." Breeders commonly assume that certain characters are contributed by the male parent, while others are as certainly inherited from the female; and physicians as well as breeders are still largely prejudiced in favour of the doctrine of "infection," the "throwing back" to a previous mate of the dam. About the doctrine of "infection," or telegony, I propose to say something in this paper. As the subject is a large one, I shall deal only with the question, Does "throwing back" to a previous mate occur amongst dogs?

There is hardly any one interested in dogs who has not heard again and again of pups far more closely resembling a former mate of the dam—a mate, perchance, of a different breed — than their actual parents, and many fanciers firmly believe that this resemblance is due to the dam having been, in some mysterious way, more or less permanently influenced—"corrupted"—by a previous and generally unsought-for alliance. Moreover, many fanciers believe that this throwing back, instead of being a rare occurrence, is comparatively common.

Theoretically the offspring should, in their characters, be about intermediate between their parents and their remote ancestors. This, however, is seldom the case, more especially when the parents are unrelated or members of two perfectly distinct breeds. In other words, even in pure-breed stock there is often evidence of variation. Whenever the offspring obviously differ from the immediate parents, the breeder naturally endeavours to account for the difference—whether it be in form, colour, or disposition. Such differences, as recent experiments clearly prove, may be, amongst other things, due to throwing back to a more or less remote ancestor, or be quite new departures—*i.e.*, due to variation in a direction new to the breed. It may very well happen that reversion to a remote ancestor may result in characters extremely suggestive of a previous mate, and that a previous mate belonging to a different strain may be more or less accurately mimicked by perfectly new departures. It hence follows that to be in a position to come to a conclusion as to any given variation one must have a very thorough knowledge of the remote as well as of the recent ancestors.

This is exactly the kind of knowledge all but unattainable in the case of any of our domestic animals, yet breeders and fanciers seldom hesitate to explain the variations they from time to time notice: in many cases, on very slender evidence, they rush to the conclusion that the differences in colour, make, &c., can only be accounted for by the doctrine of infection.

I doubt if there is any group in which it is more difficult to account for the variations so frequently met with than in the one under consideration. This is partly due to the fact that our dogs have in all probability had a multiple origin,—have sprung from several perfectly distinct wild varieties or species,—and partly to the fact that for centuries intercrossing has been, for one reason or another, repeatedly resorted to, or effected without the knowledge of the breeder. As it will be at once admitted that but few, if any, breeds can boast of centuries of unsullied pedigree, I need only refer here to the multiple origin of our dogs.

There is no evidence that dogs were used before Neolithic times. A few months ago a remarkable series of engravings were discovered in the cave of Combarelles, in the vicinity of Eyzies (Dordogne). These figures (undoubtedly engraved in Palæolithic times), which cover the two sides of a cave over 100 yards in length, include wonderfully accurate and artistic outlines of horses, deer, and antelopes, and of the great hairy mammoth, but not a single hint of either wolf or dog. One of the drawings represents a galloping reindeer. Had there been dogs in those days the artist would hardly have omitted to represent a hound following in the reindeer's track.

In Neolithic times, however, there were already three perfectly distinct breeds of dogs in Europe—(1) a small fox-like variety; (2) a large variety not unlike the Siberian sledge-dog; and (3) a slender variety resembling the Scottish deerhound. It is more than likely that each of these European varieties had a somewhat different origin, and that yet other varieties related to different members of the great wolf family occurred about the same time in Asia. In fact, all we have hitherto learned about the dog since Neolithic times onwards suggests that while some breeds may have sprung from a single species of wolf, the majority count amongst their ancestors two or more wild species of wolves, if not also some of the jackals.

About most of the present-day breeds it is impossible to trace their history even back to medieval times. We seem to know most about hunting dogs and collies, all of which seem to have sprung from the slender deerhound variety of Neolithic times. If, as is often assumed, hounds and collies have descended from one of the varieties of the later Stone Age, they will be especially suitable for experiments intended to test the truth of the "infection" hypothesis.

In dealing with the infection hypothesis, there are two very obvious lines of procedure—(1) by experiments, likely to give infection a chance of declaring itself, and (2) in the absence of positive experimental evidence of infection, to indicate that in the supposed cases of infection recorded some other explanation is equally, it may be more, feasible.

In evidence of the view that there is no such thing as infection, the late Sir Everett Millais, Bart. (an acknowledged authority on all matters relating to dog-breeding), may be quoted.

In 'Two Problems of Reproduction' Millais tells us "that in a breeding experience of nearly thirty years' standing, during which I have made all sorts of experiments with pure-bred dams and wild sires, and returned them afterwards to pure sires of their own breeds, I have never seen a case of telegony, nor has my breeding stock suffered." Continuing, Millais says, "I may further adduce the fact that I have made over fifty experiments for Prof. Romanes to induce a case of telegony in a variety of animals—dogs, ducks, hens, pigeons, &c.—and I have hopelessly failed, as has every single experimenter who has tried to produce the phenomenon."[1] He further says, what is more to the point, that on making inquiries at home and abroad — on the Continent and in America — he heard of an enormous number of so-called cases of infection, but all such cases "would not bear a critical inspection for a moment." Yet Millais, like so many others, was unable to shake himself quite free from the telegony superstition. He had no difficulty in detecting flaws in the evidence submitted by the ordinary unscientific fancier, but he failed to see in a case that came under his own observation that the evidence in support of infection was equally faulty. This was the case of a fox-terrier which because of its spots was said to throw back to a Dalmatian—a previous mate of the terrier's dam. Millais says of this case, "I have not the slightest doubt that in this fox-terrier we have a perfectly authentic instance of telegony";[2] hence he came to the conclusion that infection did occur, but was "exceedingly rare, and therefore abnormal."

That the fox-terrier in question was spotted is not for a moment questioned, but that it owed its spots to a previous Dalmatian sire is more than doubtful. In the first place, when a Dalmatian is crossed the offspring are more liable to be marked with large blotches than small round spots; and in the second place, fox-terriers, like setters and certain other breeds in which there is neither an actual nor an imaginary (telegonous) Dalmatian in the ancestry, often enough present Dalmatian-like spots. Some years ago I crossed a sable-and-white collie with a Dalmatian. The three pups obtained in no way suggested the Dalmatian sire. The body colour was of a yellowish tint, and each pup was marked with four or five large reddish blotches such as commonly occur in foxhounds. Only once in half-bred Dalmatians did I obtain spots, and in this case they were small and indistinct. I may hence say of Millais' single instance of infection that (like the enormous number of so-called cases brought under his notice) it does not bear "critical inspection for a moment."

---

[1] Two Problems of Reproduction, "Our Dogs" Publishing Co., Manchester, p. 18.

[2] Two Problems of Reproduction, p. 20.

Every year an immense number of telegony experiments (mostly unintentional) are made with dogs, and though, as a rule, no records of any value are kept, it would be possible to submit a large amount of evidence to show that, even when the circumstances are most favourable, "infection" has been conspicuous by its absence. I shall, however, only give the results of three experiments.

1. Hepsy, a black-brindled Scottish terrier by Kilgreggan out of Bannockburn Lady (two famous pure-bred terriers by "Champion" Dundee), had first of all a litter of pups to a curly-haired liver-and-white cocker-spaniel. These pups being of a brown-and-white colour, and decidedly spaniel-like in build, proved that Hepsy, though inbred, was capable of being influenced by a sire of a different strain. In due time Hepsy was mated with Roden, a pure-bred dog of her own breed. Gorst, the result of this union, was a typical black-brindled terrier with the small erect ears and wiry straight hair characteristic of the breed —*i.e.*, there was nothing about Gorst suggestive of the soft wavy hair and large drooping ears of Hepsy's previous mate, the cocker-spaniel.

Hepsy, next mated with "Champion" Revival, produced Rustic Beauty, who was as true to the terrier type as her half-brother Gorst.

Rustic Beauty proved as free of infection as her mother. To Heather Prince she produced "Champion" Gair, and to another dog she gave birth to a daughter, which, mated with her half-brother Gair, yielded "Champion" Glory.

That the subsequent offspring of Hepsy were true to type is attested by the fact that Gorst, Gair, and Glory were all noted prize-winners.[1]

2. A pure-breed Scottish deerhound, while in the possession of Professor A. E. Mettam, B.Sc. (now Principal of the Royal Veterinary College, Dublin), had first a litter of pups to a retriever. All these pups took more after the retriever sire than their deerhound dam. Subsequently

---

[1] I am indebted to Dr Stewart MacDougall for obtaining the information about these terriers from Mr Marshall, their breeder.

the deerhound had pups to a pure-bred deerhound belonging to Harry Rawson, Esq., of Joppa, Mid-Lothian. These subsequent pups in no single point suggested the previous retriever mate.

After classifying the results of a number of experiments with dogs, I came to the conclusion that the spotted carriage or Dalmatian dog and the Scottish deerhound were well adapted for testing the truth of the infection doctrine. Of several experiments made, only one need be referred to. Mona, a Scottish deerhound bred by Major Richardson, was when two years old mated with a typical Dalmatian. The result was seven pups, one slender and of a grey colour, one brown with white markings, and five black with white markings. Some of the white patches in the brown and black specimens show faint irregular spots. After an interval of eight months the deerhound was put to Corrachan, a well-known deerhound sire belonging to Mr Rawson. On the 14th October 1901 five pups were born, two of which resemble the sire, two take after the dam, while one is lighter in colour than the dam. In no single point do they suggest the previous Dalmatian mate.

In a paper on "Telegony in the Equidæ," recently contributed to the 'Transactions' of the Highland and Agricultural Society of Scotland, I pointed out that there is no evidence that either mares, asses, or zebras have ever been "infected." I may now add that the dog group, notwithstanding all that has been said to the contrary, also fails to lend any support to the doctrine of infection.

The Court of Claims and the Coronation.

By Rev. P. J. OLIVER MINOS, Ph.D., M.R.A.S. (Lond.)

OUR readers will doubtless have noticed the recent newspaper reports of the legal arguments before the Court of Claims. A few words, therefore, regarding this ancient tribunal, so unfamiliar to the present generation, may prove of interest in view of the impending Coronation of Edward

VII. The Court of Claims is an ancient institution, having records dating back to the reign of Richard II. In the earlier days the sovereign, soon after accession, issued a warrant constituting the Lord High Steward sole judge of the Court of Claims; but Queen Victoria, by proclamation, intrusted the duties of the said Court to the whole of the Privy Council, or any five of its members, and this precedent has been followed by the present king.

The claims are chiefly of those persons who hold estates by "grand serjeantry"—*i.e.*, according to Littleton, "where a man holds his lands or tenements of the sovereign by such services as he ought to do in his own person, as to carry the King's banner, or his sword before him, at the coronation, or to be his carver or butler."

On the present occasion the labours of the Court of Claims are made easy by the fact that the peers who at the last coronation respectively performed the functions of Earl Marshal of England, Lord High Steward, the bearers of the Golden Spurs, the Orb, the Custana or Sword of Mercy, the Second Sword, the Third Sword, the Sceptre with Dove, and King Edward the Confessor's staff, have lineal descendants or representatives. There remains, therefore, among the more important offices only that of carrying the Sceptre with the Cross, vacant by the extinction of the Dukedom of Cleveland, and the appointment of Lord High Constable of England, which is not hereditary, but is usually conferred upon a distinguished military officer. The great Duke of Wellington was Constable at Queen Victoria's coronation.

The rival claims of the Earl of Ancaster and the Marquis of Cholmondeley to the office of Lord Great Chamberlain of England have been referred to the House of Lords' Committee on Peerage Claims.

In addition to the great and hereditary offices, there are other claims from persons who hold manors and estates on condition that they render personally some menial act at the Coronation. Some of these become unnecessary, owing to the King's Proclamation of June 26, 1901, dispensing with the services of all persons who claim and are bound to perform any service or services in Westminster, in Westminster Hall, or in the procession. The most curious of all such minor claims is that of providing a man on Coronation Day to prepare in the King's kitchen a mess called "dillegrout"—*i.e.*, a variety of porridge—as service for holding lands from the Sovereign in Addington, Surrey. Another quaint service is that of holding the towel when the Sovereign washes hands after dinner on the Coronation Day. The holder of lands at Heydon has this privilege according to the record on the Exchequer rolls. Three maple cups are to be provided by the Lord of the Manor of Nether Bilsington; also the Earl of Derby has to present two falcons to the Sovereign as Lord of the Isle of Man.

There are instances where a fee of some kind was given for services rendered, and it usually took the form of the implement by which the particular service was performed. For instance, the Lord of the Manor of Liston, for making wafers for the Sovereign, received the implements of silver and other metal used, as well as the linen napkin for serving the wafers. The claims of the barons of Cinque Ports—viz., the sixteen freemen of the towns of Hastings, Dover, Hythe, Rye, Sandwich, Romney, and Winchelsea—to carry over the Sovereign during the procession a canopy of cloth-of-gold, receiving the same as their fee, and having the privilege of dining at a table at the right hand of the Sovereign. The hereditary services of the King's Champion for the Manor of Scrivelsby in Lincolnshire, I think also becomes unnecessary, as the Champion's challenge was made at the feast in Westminster Hall between the first and second courses.

Lastly, there are claims too obsolete to be revived, such as the office of Chief Lardener, held by the Earl of Abergavenny, whose duty it was to take charge of the larder, and he received as a fee "the remainder of all loaves, muttons, calves, venisons, cheverels, lard, and other flesh, fish, salt, &c., remaining after dinner." The office of Carver was the privilege of the Earls of Lincoln. The office of Panneter was held by the proprietor of the Manor of Kibworth-Beauchamp, in Leicestershire. The customs of the Lord Mayor of London presenting a gold cup full of wine to the King during dinner, and that of the Recorder presenting one after dinner, and receiving as their fee the cups, also should be mentioned. This custom can be traced back as far as the reign of Richard II., when the citizens of London claimed not only that their Mayor and Recorder should present cups of wine, but that they, the citizens, should serve in the butlery. They also claimed to serve in the buttery, a duty which was shared with the Mayor and burgesses of Oxford. The last occasion on which a cup of wine was presented by the Lord Mayor was at the coronation of George IV.

Notes on Cinque Ports.

In Anglo-Saxon times there were three — viz., Dover, Sandwich, and Romney. William the Conqueror added Hastings and Hythe; and because Hastings was the place of his victory, he granted special privileges upon it, and made it the head and chief of the Cinque Ports. These were confirmed by charters of Henry I. and Edward I. Winchelsea and Rye were allowed nearly, but not quite, all the privileges belonging to the other five. In place of the Saxon terms of Aldermen and Freemen, the Cinque Ports rejoiced in "jurists" and "barons." This last until the Reform Bill was the title of an M.P. of any of the Cinque Ports.

In the reign of Henry VIII. it was ordered that "everie person who goeth into the navy of the Portis shall have a cote of white cotyn with a red crosse and the arms of the Portis underneath; that is to say, the halfe lyon and the halfe ship." And at the coronation of James I. it was ordered that the dress of the canopy-bearers should be "a scarlet gowne downe to the ancle, citizen's fashion, faced crymson satteen, Gascaine hose, velvett shoes, and black velvett capes."

The barons performed their duties at George IV.'s coronation, but not at William IV.'s.

The Field Naturalist's Library.

REVIEWS OF BOOKS, TRANSACTIONS, ETC.

THE COUNTRY MONTH BY MONTH. J. A. Owen and G. S. Boulger. Pp. 492. London: Duckworth & Co. Price 6s. nett.

The plan of this book is so in accordance with our ideas of the requirements of field naturalists that we give this new edition a very hearty welcome. Miss Jean Owen, who edited the works of "A Son of the Marshes," is responsible for that portion which treats of birds and other animal life, while Professor Boulger has done the botany and entomology. The work is divided into twelve sections—one for each month of the year. Not the least valuable portion is the addition of the notes and comments of the late Lord Lilford, which are in themselves a criticism of each section as far as the birds are concerned. The smaller mammals and the reptiles receive scant attention from Miss Owen (a feature too common in popular works on natural history), and this is the most disappointing part of the book. We are not aware of any authentic record of *T. natrix*, the ring snake, of six feet in length, a measurement stated to occur "sometimes," nor have we ever encountered a specimen of this species which had swallowed a "small rabbit." The evidence in support of both these statements would be very welcome.

An interesting section is that on mistletoe, though we doubt whether the downward growth of this evergreen parasite is as common as supposed. We counted thirty bunches of mistletoe in a Herefordshire lane the other day, of which twenty-seven grew upwards, two horizontally, and only one downwards. Doubtless the mistletoe frequently does grow downwards from the bough, but very often it is otherwise. The statement on p. 225 that the dormouse during the summer "lays up its store of food" for winter use will interest Mr Forrest, whose observations on this mammal we record elsewhere. We heartily endorse the opinion that "the fit place for a wilful destroyer of any owl in our country would be an asylum for idiots." Would that gamekeepers spared them more!

The botanical part of this book is excellent, and tells the field worker just what to look for and where to find it. As bearing on the present season we quote the following from the section on February:—

"It might be supposed that there is but little work for the entomologist in winter. Few insects are seen upon the wing, and food-plants are mostly either bare of leaves or dead down to the level of the ground, so that we should not expect to find many larvæ. . . .

"Even in the severest weather, however, there will be some work that can be done out of doors. New districts can be visited, and notes made of the general character of their vegetation with a view of their future value as hunting-grounds. Now, too, is a favourable season for collecting the eggs of moths and butterflies. . . .

"Contrary to popular belief on the subject, a severe winter is favourable to insect life; for the majority of insects are then in the egg stage, and their eggs can withstand a considerable degree of frost without losing their vitality, whilst the ranks of the insect-eating birds are sadly thinned by cold.

"Though we can hunt for insects' eggs in January, many will perhaps be willing to indorse the view that February is the month in which outdoor natural history should begin. If we choose a bright day . . . we may collect a goodly variety of eggs. Cheap pill-boxes will be the best form of collecting apparatus, and great care must be taken to note the food-plant in each case, as few of us are likely to be able to identify all the eggs we find, until they have hatched, and the larva seems to come into the world with a mind so exclusively set upon eating that his life will brook no delay."

Altogether, 'The Country Month by Month' must prove a most valuable help to field naturalists in the intelligent pursuit of their hobbies.

BRITISH VEGETABLE GALLS. Edward T. Connold, F.E.S. Hutchinson & Co. Price 10s. 6d., already raised to 15s.

Mr Connold, who is the secretary of the Hastings and St Leonards Natural History Society, is to be congratulated on the completion of his labours, and his book will be a welcome addition to the somewhat sparse literature of this subject, welcome alike to the botanical and entomological student. As far as we are aware, it is the first work of its kind which deals exhaustively with the subject, and is the result of years of patient practical study and research on the part of a conscientious field naturalist. The author has adopted an easy colloquial style, while at the same time carefully avoiding the sacrifice of the technique. A definite plan has been adopted for a concise and clear description of the specimens, and a synoptical table formulated, and each gall is described according to its plan, thus producing a uniformity throughout the entire work which is one of its distinctive features.

The 300 pages of letterpress are illustrated by 130 full-page plates and 27 small drawings. All the specimens were collected by (or for) the author expressly for this work, and were photographed by himself. No praise can be too high for the manner in which the publishers have reproduced these photographs,—they are true works of art. They are so arranged that the distinctive features of each gall may be easily recognised.

In the opening chapters the author deals with the nature of galls, their sizes, shapes, and colours; the collecting, mounting, and preserving of them; their mode of growth; their classification; and the agents concerned in their production. The next portion of the volume is devoted to detailed descriptions of about 100 different galls, these being divided into root-galls, stem-galls, leaf-galls, and flower-galls. The book concludes with several tables of galls, makers, plants, oak-galls, &c., and a bibliography, all of which are valuable. About 340 galls are mentioned in the book, which will give the reader some idea of the extent of the subject.

We notice that the original published price has already been advanced, so that intending purchasers should at once possess themselves of the book.

We heartily commend Mr Connold's book to our readers, and the more so as its author is a true field naturalist. His book should be an encouragement to all outdoor workers, as showing what valuable work can be done by one who determines to follow up a subject in all its aspects.

TRAVELS ROUND OUR VILLAGE. E. G. Hayden. Illustrated by L. Leslie Brooke. Pp. 321. A. Constable & Co. Price 7s. 6d.

Miss Hayden's description of the men, women, and things in the quiet Berkshire village she evidently loves so well will delight all lovers of country life. The only faults we have to find with this book are the introduction of too many long recipes for the making of elder wine, mountain-ash jelly, and other rural dishes ; and the quotation of the very old story of the rustic who preferred to die a natural death to having a doctor, as proof of the "ignorance and simplicity prevalent among the shepherds of the Downs." But the pictures of the people themselves are most refreshing, and often very touching. The story of Emmanuel Welsh and his coquettish village sweetheart ; the description of Mrs Snell and the old grandfather who returned his age on the census paper at 206 years ; the election of the first parish council,—these and many other scenes of village life are admirably portrayed. Field naturalists will find many paragraphs touching on the plants and animals found in or near the parson's meadow. "On one side is a disused drain, the home some years ago, before he removed higher up the stream, of a badger that wrought sad havoc with the tennis-lawn, turning it up from end to end that he might reach the tender shoots of fine grass which suited his fastidious palate better than the coarser product of the meadow. Next in succession as the tenants of the drain came a pair of stoats, who lived there in great content and reared a creditable family : they were followed by rabbits, and these last are so well pleased with their residence that they refuse to vacate it. Other wild creatures are also to be found—weasels and harmless green snakes, which on account of their family resemblance to the adder are too often done to death by the children. Adders, indeed, are rare, though on one occasion the kitten was found playing in cautious fashion with something that was not a ring snake." What was it, we wonder,—a slow-worm, or one of the rare smooth snakes that, according to Mr J. L. Bevir, were not uncommon in Berkshire some twenty years ago ? Miss Hayden gives no hint of the identity of the reptile. This chapter (XII.) from which the above quotation is taken is one of the most charming in the book ; but every page almost has its own charm, and we cordially recommend all lovers of the real country—not suburbs—to read Miss Hayden's book.

The drawings of the villagers and rural scenes by Leslie Brooke are excellent, and the "get up" of the book leaves nothing to be desired.

THE NATURALIST'S DIRECTORY, 1902-1903. Pp. 168. L. Upcott Gill, 170 Strand, W.C. Price 1s. 6d. nett.

Those of our readers who do not happen to be familiar with this publication will do well to obtain the new edition, for it contains a mine of most useful information for the field naturalist. It would surprise a new reader to find that the first 74 pages are taken up with the names and addresses of persons interested in zoology, the next 13 pages are microscopists, then 16 pages of botanists and 15 of geologists and palæontologists.

There is a complete list of all the societies, field clubs, and museums, with the names and addresses of the secretaries and leading officials for the whole country, together with a geographical index. There is also a trade directory and a bibliography of natural science publications.

By means of this book the student can at a glance find out who are interested in his subject, and their addresses for correspondence, so that he need never be at a loss to obtain further information on any branch of field work. The 'Naturalist's Directory' should be on the desk of every field naturalist.

Field Clubs and Societies.

The Thirtieth Annual Report of the Chester Society of Natural Science, Literature, and Art contains the record of a vast amount of good work done in the year by its members. With a membership of 920 in all sections, this society, which was founded by Charles Kingsley in 1871, is in the forefront of English natural science societies, and its office-bearers have no doubt a very justifiable pride in its success. The curator (Mr R. Newstead, F.E.S.) reports the addition of 2979 specimens to the museum, largely contributed to by Mr T. A. Coward by the presentation of his collections of fossils, minerals, and local eggs. The meteorological observations taken bi-daily by the Rev. J. Cairns Mitchell, F.R.A.S., are a model of what such records should be ; and Mr A. E. Goodman's illustrated paper on photo-micrography is valuable. The direct and indirect educational influence of this society must be enormous : would that there were more as flourishing !

The Eighth Annual Report of the Hastings and St Leonards Natural History Society records that "all the meetings have been well attended." A membership of 235 indicates, we hope, a keen interest in local and general natural history. The secretary is Mr Ed. Connold, whose new work, 'British Vegetable Galls,' is noticed elsewhere. An interesting note is the following : "The common little beetle, Apion trifolii, L., which usually feeds in the heads of the clover, has this year greatly damaged some scarlet-runner beans at Fairlight, making skeletons of the younger leaves and eating small holes in the pods, so that they were dotted over with dark spots. It appears that a clover-stack had been erected close to the beans, and the little beetles, in myriads, forsook the dry clover for the tender leaves and pods of the beans." A most attractive list of thirteen evening meetings for the ensuing session is announced, most of them illustrated with lantern views.

The last Annual Report of the Ornithological and Zoological Section of the Uppingham Natural History Society—drawn up by C. R. Haines, Esq., the president and secretary—contains some local and general information of interest. Of the rarer birds the report says, "Most of the rarer additions to our list come from the ornamental waters at Exton and Burley, or from the Welland Valley. At Burley has been killed within the last few years one of the rarest of British birds, Bonaparte's Gull; and such splendid birds as the Osprey and Peregrine and Hobby occur occasionally." The identification rests solely on the authority of a Canadian ornithologist, Mr Wm. R. Hine of Southport, who is familiar with Bonaparte's Gull, and on seeing the wings (the only part preserved) of above specimen at once identified them. The wings have since been mislaid by Mr Hine.

In connection with the subject of "Bird Song in Winter," treated of in another column, this report states: "The robin, hedge-sparrow, and wren sing occasionally throughout the autumn and winter, and the lark often in November; but this year the thrushes sang from 6th November onwards till 15th December, and I heard a linnet singing lustily on November 10. The Earl of Gainsborough remarked the note of the ring-dove and stock-dove as late as December 15, and again as early as February 18. According to my experience the tits begin their song early in February, and the blackbird is seldom heard before the same time, the chaffinch and lark a little later." Mr Haines has some good remarks on the wilful destruction of large numbers of eggs by collectors, who, as he says, "are the curse of the country districts." The report concludes with a summary of the fauna of Uppingham District, the detailed observations of birds, mammals, reptiles, and amphibians being given. In the last group—the amphibians—we note there is no record of the palmate newt being seen. There is said to have been a noticeable diminution in the number of swallows and martins at Thorpe-by-Water, while the stone-chat is added to the local list for the first time since 1856.

The 17th Annual Report of the Heaton Chapel Literary and Philosophical Society bears witness to the interesting character of the meetings during the session 1900-1901, as well as to the very flourishing condition of the society. A membership of 740, of whom 429 are ladies, is indeed a gratifying state of affairs, and one which any society might be proud of. The report contains two excellent portraits, one of the late president, Mr P. S. Minor, and the other that of the present president, Rev. W. H. Smartt. With such men at its head the society will doubtless continue to flourish. Mr Smartt is one of the readiest speakers we know, and always witty. We remember on one occasion recently, when a lecturer to the society had advanced a theory to account for the absence of serpents from Ireland, Mr Smartt in his speech afterwards said that he could not agree with the lecturer's view of this matter, the reason for this immunity being simply that "Ireland could not produce anything so ugly as a snake." Mr Smartt is an Irishman, evidently.

The lectures of the past session embraced a variety of topics, "Wireless Telegraphy," "The Track of the Moors in Spain," "The Ancient Glaciers of Snowdon," "Round the World on a Bicycle," being some of the titles. In addition there was a series of extension lectures by Mr G. C. Henderson on "Four Mediæval Heroes." The average attendance at the lectures was 240. The president's retiring address on the history of the society contains words of wisdom which apply to all institutions of a similar character, and Mr Minor did well to urge the members not to be content with "lazily listening to lectures illustrated with lantern slides." These are good in their way, but should not be allowed to altogether take the place of papers and debates from the members themselves, and which this society could doubtless provide *ad libitum.* We congratulate Mr Lister, the secretary, on his flourishing work.

The Transactions of the Caradoc and Severn Valley Field Club for 1901 has just been issued by the hon. sec., Mr H. E. Forrest. It contains many interesting notes on Shropshire fauna, and full reports of the excursions and evening meetings of the club. The only new species added to the county fauna in the year is the lesser shrew (*Sorex minutus*), a specimen of which was taken at Middletown last March. Four nests of the tufted duck were found near Whitchurch, and were reported in the 'Zoologist' for November 1900. The president in his annual address made a strong appeal for more geological work to be done in the county, and pointed out some problems that might engage the attention of members. The evening meetings included a lecture from Dr Gerald Leighton on "The Snakes of the Monnow Valley," in which the lecturer dealt with the factors determining the distribution of our snakes in any particular locality. He also showed that locality has very little to do with the colour variation seen in adders, the variation being due to age and sex.

A feature of this society is the annual "long meeting," which extends over a week, and in 1901 was in the neighbourhood of Brecon. It speaks well for the club that twenty members attended. Geography and archæology were the chief subjects studied. Mr Forrest gave three evening lectures on "The Fauna of North Wales," on which he is writing a book, and his notes on this much-neglected area from a literature point of view are of great value. The society evidently has a few really good workers.

Questions and Answers.

BOTANY.

1. What are the most common plants that may be termed *poisonous?*

Answer. Common nettle (*Urtica dioica*); small nettle (*U. urens*); the introduced plant Primula obconica; the hemp-nettle (*Galeopsis Tetrahit*); and the *Galeopsis versicolor*,—these all acting by contact. Monk's-hood (*Aconitum napellus*); the great spearwort and lesser spearwort (*Ranunculus lingua* and *flammula*); the celery-leaved crowfoot (*Ranunculus sceleratus*); hemlock (*Conium maculatum*); the bittersweet (*Solanum dulcamara*),—all these acting through being eaten. An excellent paper dealing with these and other poisonous plants appeared in the 'Transactions of the Edinburgh Field Nat. and Micro. Soc.,' vol. iii., 1896, p. 152, by Mr Mark King, to which refer.

(The Editor invites questions for this column on any branch of fieldwork: the questions and answers will be printed together. Correspondents may send the answer to their own questions, if the object is to draw attention to a point of interest.)

Correspondence.

REPTILIA.

"I WAS walking up the Back Lane, Liskeard, Cornwall, about the middle of one very hot and sunny day, when I came upon a female adder with two young ones enjoying a wriggle in the sand. I intended to kill the mother and capture the two young ones, but to my astonishment the little ones took shelter in the mother's mouth so promptly, as if to the manner born, that I watched with interest the mother take to the hedge, where she disappeared. The two young adders were very much like young lampreys, about one-third grown. I was only about three yards distant from the mother.—Yours, &c., Robert Dunstan, M.R.C.S."

(See also 'Westminster Gazette' of October 1, 1901, and following issues. The above is the only instance we have known of a medical man having testified to witnessing this disputed occurrence, and it is therefore of much interest.—ED.)

"I should like to record an instance of an adder swallowing its young which I witnessed. I was about seven years old, and was walking with two nurses in the woods at Bryanston, Dorset. We were in a broad green drive, and came rather suddenly upon an adder lying in the middle of it, the reptile's head towards us and a number of young ones round it. As soon as the adder saw us it opened its mouth and the young ones rushed in, all disappearing in a few seconds. Such a sight would be sure to make an impression on the mind of a child, and I have never forgotten it, but could go now to the very spot; and whenever I think of it the whole scene comes before me, though it happened more than fifty years ago."—Emily Godolphin Osborne, Bishop's Cleeve, Cheltenham.

(This being the first number, no correspondence is to hand. The above are from recent letters to the editor on British serpents.)

Young Naturalist's Quarterly Competition.

In order to encourage the study of natural history and other scientific subjects, the Editor offers prizes every quarter for the best essays sent to him on the prescribed subjects. The competitions are open to all young students and scholars, and are specially intended for the pupils of public schools, colleges, &c., which have natural history and other societies for their scholars. Competitors must send their essays in their own handwriting, together with a statement from their head-master or clergyman certifying the essay to be the original and unaided work of a competitor under nineteen years of age. Essays should not exceed 1000 words, but may be as short as desired. In awarding the prizes, the Editor, whose decision is final, will take into account both the accuracy of the matter and its arrangement. The results of the competitions will be announced in the following quarter's issue. The successful competitor must then select his or her prize from those offered, and inform the Editor at once where the prize is to be sent to.

The Editor reserves the right to publish any of the essays sent in.

Note.—The subject of the first competition is, **"The Effect of the Winter Season on British Bird Life."**

Competing essays (with statement of age and originality) must reach the Editor of the 'Field Naturalist's Quarterly,' Grosmont, Pontrilas, Hereford, on or before April 5, 1902. Envelopes to be marked "Competition Essay." The prizes will be announced in the next issue of this journal. First prize, any three of following books; second prize, two of ditto; third prize, one of ditto:—

Types of British Animals (Aflalo).
British Vertebrates (Aflalo).
A Walk through Zoological Gardens (Aflalo).
A Year with Nature (Westell).
Fauna of Shropshire (Forrest).
British Serpents (Leighton).
The Country Month by Month (Owen and Boulger).
Norfolk Broads and Rivers (Davies).

Design in Nature's Story (Kidd).
One Thousand Objects for the Microscope (Cooke).
Animal Coloration (Beddard).
To-day with Nature (Robinson).
The Vivarium (Bateman).
&c., &c., &c.

Notices.

TO CONTRIBUTORS AND CORRESPONDENTS.

ALL articles and other communications (typewritten if possible) intended for publication, and all books, Transactions, papers, &c., for review or other notice, should be sent to the Editor, 'Field Naturalist's Quarterly,' Grosmont, Pontrilas, Hereford.

Business communications should be addressed to the Manager at 45 George Street, Edinburgh.

Contributors are requested to write the department to which their communication refers (*e.g.*, Ornithology) on the envelope.

Every effort will be made to return unused communications where stamped addressed envelopes are enclosed for that purpose, but contributors are advised to keep copies of their MS., as the Editor cannot undertake responsibility for their non-return. Photographs or other illustrations sent for publication must be original and the absolute property of the sender.

The full name and address of the sender must accompany every communication. Anonymous communications will not be noticed. Correspondence is invited on all matters of general interest which fall within the scope of work usually done by field clubs and kindred societies. Original observations on the habits of living animals and plants will be specially welcomed.

The 'Field Naturalist's Quarterly' will be issued in February, May, August, and November; and all communications for the ensuing issue should reach the Editor at least one month in advance.

TO SUBSCRIBERS.

The annual subscription to the 'Field Naturalist's Quarterly' is 10s. post free. Single issues 2s. 6d. each. Subscriptions, which may begin with any issue, should be sent to the Manager, 'Field Naturalist's Quarterly,' 45 George Street, Edinburgh.

The 'Field Naturalist's Quarterly' may be ordered direct from the publishers, Messrs Blackwood & Sons, or through any bookseller or newsagent.

To Advertisers.

Applications for terms and spaces to be sent to the Manager, 'Field Naturalist's Quarterly,' 45 George Street, Edinburgh.

Special terms for selected places, or a series of (changeable) advertisements.

The Editor begs to acknowledge the receipt of the following Annual Reports and Transactions:—

The Chester Society of Natural Science.
The Hastings and St Leonards Natural History Society.
Uppingham Natural History Society.
Heaton Chapel Literary & Philosophical Society.

PRINTED BY WILLIAM BLACKWOOD AND SONS.

From a Drawing by Frank Southgate.

PARTRIDGES—A SPRING EVENING.

The Field Naturalist's Quarterly

VOL. I. MAY 1902. NO. 2.

Editorial.

WITH the advent of spring Field Naturalist Clubs all over the kingdom will once more resume active operations. How vast is the scope of work on all sides calling for observation is a subject that need not be laboured here. But the great importance of the work that is done by such organisations is frequently unappreciated by the general public, and the societies themselves in many localities do not receive that local support which might reasonably be expected. We gladly recognise, however, that this feeling of apathy is gradually becoming a thing of the past, and it is certain that at no previous date was there, on the whole, so much attention given to what may be termed local natural science. As to what precisely should be the functions of Field Naturalist institutions opinions differ, some taking a much more restricted view of their duties than others. Obviously the nature of the particular district concerned must be an important consideration. For ourselves, we would have the greatest latitude allowed and encouraged in selecting subjects to which the members of field clubs should turn their attention. The personal tastes of individuals vary immensely in these matters as in others, and to restrict the work of a society to one branch of science means the multiplication of societies in the same locality, and a diminution of the general educative effect of field work. In other words, it is the ordinary well-educated man or woman who should be encouraged to join these bodies, and who should find in them a world of interest, hitherto possibly unsuspected. As time goes on the serious field naturalist will inevitably be drawn towards some particular branch of science, and it is at this point that the work of the "one-subject" society comes in. He now becomes a specialist, but had it not been for the existence of the field club, he would never have got that first glimpse of the wonders of nature, the powerful effect of which has impelled him onwards ever since. But many members remain behind, unable or unwilling to specialise,—and it is by no means desirable that all should do so,—and new members are being constantly introduced; and it is for this numerous class that the field club should particularly cater; for if it does not, nothing in our present system of education can take its place. In a very large club it is advisable to have sectional meetings as well as the general ones, thus encouraging those who wish to advance in special subjects, while not neglecting the ordinary member.

The great justification of a field club ought to be that it is doing work that is otherwise neglected. There is not an area of ten miles square in this country but what offers some object of investigation. Hence it is that Archæology is one of the subjects which field clubs largely study. In our opinion they are amply justified for so doing, though we at the same time think that more attention might certainly be paid to the animals, more especially the smaller mammals. But the preservation and interpretation of ancient landmarks in the shape of buildings, as well as the protection of plants and animals, fall well within the scope of the functions of field societies, and such clubs as the Essex Field Club have done very valuable work in these directions. That the value of such work is now becoming recognised needs no further proof than the fact that this particular club was the object of a well-deserved tribute in a leading article in the 'Standard' only a few weeks ago. After a reference to the work of the club in connection with the investigation of Ambresbury Banks, the exploration of Dene Holes, and other matters, the writer concludes thus: "Institutions of this kind do no small service to the country. How often, in past times, have valuable finds been lost because nobody particularly cared about them, and the discoverer was ignorant of their value. Now, with members in every district,—all, at anyrate, having some general knowledge,—nothing is likely to be lost. Everything of interest is almost sure to be noted and preserved, and not the least of the good work done by such clubs is the effort to protect the rarer plants and animals."

* * * * *

In view of the correspondence which we publish in this issue, and of a note by that excellent observer Mr Eagle Clarke in the last number of 'Annals of Scottish Natural History,' we ought probably to confess that we are wrong in our belief that the adder does not habitually take to water. The incident quoted by Mr Bevir did not take place in this country, but at the same time there is no other serpent in Scandinavia the markings of which could be mistaken for those of the adder. There are two possible fallacies, however, in the story. One Mr Bevir himself points out—namely, that the adder may have fallen off one of the rocks into the water. The second, and in our opinion the more likely, is suggested by G. A. Boulenger, and it is that some person may have killed the adder and thrown it into the water, where it was swallowed by the trout. Mr Eagle Clarke's case is absolutely definite. He saw the adder swimming, caught it, and killed it, so that there is no possible doubt that in this instance an adder had taken to water. Mr Thompson, too, relates an incident which points to a similar occurrence. We can only say, under these circumstances, that probably the adder does take to water sometimes, and express the regret that during a long adder-hunting career we have never been fortunate enough to meet an adder either in the water or apparently likely to enter that element. That experience seems to have been shared by both G. A. Boulenger and Hans Gadow, the latter of whose book on Amphibia and Reptiles is noticed elsewhere. On p. 643 of that work Dr Gadow says, referring to the adder, "They cannot climb, and they avoid going into water." It is just one of those points which the field naturalist of all persons has most opportunities of settling, and we should be glad to have any other instances of the occurrence reported to us.

* * * * *

How many field naturalists, we wonder, have any conception of the complexity of the migrations of some of our common birds? Most of the information on the subject has remained respectably buried in the reports of the British Association, to which but few field workers have the opportunity of access. A case in point is the statement of Mr W. Eagle Clarke to the Bird Migration Committee last year, which deals with the "histories of the various migrations performed annually within the British area by the skylark and the swallow." The degree of migration in our native skylarks is said to depend on the two factors of varying climate and food-supply. Thus in the south-west of England, and in Ireland, there is less migration than in other parts which are more exposed to winter cold, and to such districts the skylark is a summer visitor only. Mr Eagle Clarke sums up these complicated movements under the following headings, which will enable our readers to see the great difficulty of the problem in the case of this particular species:—

> The various migrations of the species may be conveniently separated and arranged as follows, beginning with the autumnal movements; and when it is considered that several of these movements are often simultaneously in progress, some idea of their complexity and the extreme difficulty of their interpretation may be realised:—
>
> 1. Autumn Emigration of Summer Visitants, with their offspring —*i.e.*, home-breeding and home-bred birds.
> 2. Autumn Immigration of Winter Visitants from Central Europe.
> 3. Autumn Immigration of Winter Visitants from Northern Europe.

4. Autumn Passage from Central to Southern Europe along the British coast.
5. Autumn Passage from Northern to Southern Europe along the British coast.
6. Winter Emigration from, and Partial Migration within, the British Islands.
7. Spring Immigration of Summer Visitants, and return of Winter Emigrants.
8. Spring Emigration to Central Europe from the British Isles.
9. Spring Emigration to Northern Europe from the British Isles.
10. Spring Passage from Southern to Central and Northern Europe along the British coast.

But even this is not all, for the movements which take place between Great Britain and Ireland, as well as between Great Britain and the Hebrides and Northern Islands, have also to be considered.

* * * * *

Our spring illustrations are all of creatures more or less familiar to the field naturalist, but, we trust, not the less welcome on that account. Mr Southgate has gone to the partridge for his example of pairing birds, and it is held by some that the partridge has but one mate. The nest is built in April, and the eggs number up to 18. Mr Dewhurst illustrates the nests of the peewit or lapwing, which has usually 4 eggs, and that of the moor-hen or water-hen, a familiar bird on many inland waters, the eggs of which vary in number from 6 to 9. He also took the photos of the larva of the puss moth on poplar, and the moth itself on willow. The photographs of the death's-head moth and the convolvulus hawk moth, as well as that of the small tortoise-shell butterfly, are by Mr J. Peat Millar. The field naturalist who is a photographer will be perfectly happy for the next few months of the year, and some of his difficulties may be smoothed by the advice tendered by Mr Watkins in his article on "Animal Photography" (p. 138).

Butterfly-Hunting in the Alps.

By H. Rowland-Brown, M.A., F.E.S.

The inhabitants of a Swiss hotel during the holiday months at a popular resort may be divided up into three classes: the permanent residents abroad who make it their summer quarters; the *pensionnaires*, doing a month or a fortnight; and the casual tramp, putting up for the night and leaving betimes next morning. To the second division, and occasionally to the third, belongs the naturalist; but peripatetic entomology, at any rate, is not an easy matter.

To enjoy alpine collecting a week at least in one place is much to be desired, and, unfortunately, with the summer holidays fixed for August, the time even then is short for many species and late for fine specimens. Collectors whose bags have hitherto been confined to the butterfly fauna of the United Kingdom will find, however, that even so far on in the season there is more than enough to occupy all their energies, and the first day well spent on the high mountains or along the roads leading up to them is a day to be marked with a white stone. Fortunately, the most frequented places—Zermatt, Chamounix, Berisal, and Leuk—are also among the most favoured localities for butterflies. With a limitless extent of uncultivated ground enriched with a flora peculiarly its own, a scarcity of small birds, and of wholesale collectors, insect life in the Alps is prodigal of numbers, varieties, and variations. I have taken or observed on the wing in a single day in Switzerland or the Alpes Maritimes as many different sorts as are included in the whole British list put together, including "doubtfuls" and certain immigrants like the Camberwell Beauty (*Vanessa antiopa*), the Painted Lady (*Pyrameis cardui*), and the Clouded Yellow (*Colias edusa*). On one single expedition up a small mountain overlooking the Brenner Pass, during the last days of July 1900, I remember to have counted sixty-eight separate kinds of butterflies alone; and no one species, where it occurred, can be said to have been rare.

The mountain fauna of the United Kingdom is comparatively limited, and species which are common enough in the lowlands are not represented at any altitude, as in the Alps. For instance, the familiar Brimstone of the hedgerows I have seen careering wildly over the moraine at 8000 feet, miles away from his native buckthorn, if, indeed, the larva of the alpine Brimstone feeds on buckthorn at all. The Swallow-tail of the Cambridgeshire fens, never, to my knowledge, reported from the mountains of Great Britain, is also a familiar and welcome object by the roadside among the great cow-parsnips and umbelliferous undergrowth, and it continues to within a very short distance of the snow-line. The Highlands of Scotland are notoriously poor in butterflies,—remember I am speaking of *butterflies* only,—so are the mountains of Wales, Ireland, and the Lake Country. We have but one truly alpine representative of the great "Ringlet" family, *Erebia epiphron*, var. *cassiope*. The mountains of Europe between them can show some three-and-thirty, with power to add to their number, and an incredible range of varieties. Again, I have found insects like the Queen of Spain Fritillary (*Argynnis lathonia*) flying over the ice and snow below the Mountet hut (9495 feet) at Zinal, and you certainly do not expect to find our May and June Orange Tips thousands of feet above the sea-level in August. The tremendous strength of the seemingly fragile butterfly's wing has often revealed itself to me on the higher mountain climbs; but, as British collectors have so far confined their inventiveness to labelling only their own butterflies with English names, I shall have to use the far more beautiful if seldom appropriate titles bestowed by scientists upon species which occur in the mountains and elsewhere across the seas. Our familiar friend the Small Tortoiseshell (*Vanessa urticæ*), the first of hybernated butterflies, as a rule, to put in an appearance, and very often the last to go, is a tremendous climber. In the Alps, while varying little in size, the wings are certainly of a more brilliant orange-red, and the black patches and spots, with the little blue border on the lower wings, are intensified in a way sometimes seen in specimens from the Scottish moors. Ice and snow, mist and sterile crag, have no terrors for him. I have watched the well-known wings expand upon the last great golden daisy (Doronicum) at perhaps 8000 feet; in the dip of the pass, where the snow lies thickest, at 10,000 feet, I have been forestalled by the butterfly of the lowly nettle.

The numerous dead insects lying on the snow-covered slopes which are not indigenous to these altitudes have always been more or less of a mystery to me. What prompts the migration in a species not otherwise given to roaming? What is the cause of their untimely end? Sometimes, undoubtedly, the cold has proved too much for the wanderer. I remember picking up two or three frozen specimens of *Colias phicomone*—alpine first cousin to our Clouded Yellow—with a yellow-green-winged male and a pure primrose-white female. It was on a pass which leads from the Oetzthal to a valley above Meran, in the Austrian Tyrol. I do not know how long the insects had lain there,—I was on the ice at about six in the morning,—but one that I put into a box showed signs of vitality on exposure to the sun, and had recovered enough to flutter its wings when I left it behind below the snow upon the other side. Other dismembered or broken insects found on the ice I believe to have been brought there by birds, or at anyrate attacked in their flight or when in a semi-torpid condition. The ravens, crows, and the little snow-bunting, which haunt the mountain-side, prey, no doubt, upon the insects of these lofty regions. Where the snow does not lie at all I have come across birds, insects, and flies as high as 12,000 feet on the Besso at Zinal, for instance, and I could not believe that the crows were attracted thither, as the guide declared, simply on the off-chance of crumbs and scraps of meat from our knapsacks.

But what induces lowland insects to make these ascents still baffles my comprehension. Ordinarily the female flies in search of the food-plant whereon to deposit her eggs, and the male seeks the companionship of his lady, or—I regret to add it—the favoured localities where honeyed flowers provide unlimited potations. For it is a well-known fact that, whereas the more sober-clad female in most species is a diligent, hard-working sort of body, the male is a notorious patron of strong liquors and other far less refined delicacies! There is a story related of a German professor whose exertions made him the particular object of attention to the butterflies of certain tropical species. I have found that perspiration attracts insects, mostly of the undesirable and undesired orders, but it has been observed that persons who suffer from gout and other affections of the blood are as often as not exempt from their attacks. This by the way, or perhaps I should say *these* by the way, for they are almost invariably in irritating attendance, especially in the pine-woods and the long grass.

Among old friends, the Whites are the last to desert us on passing from the lower to the upper zone. There are, however, two species, which must not be confused. That ordinary-looking butterfly is not the form of the Green-veined White (*Pieris napi*) which occurs at home in the spring and autumn months. On examination, the green marking will be found to have nearly disappeared, and the wings are so suffused with black as to appear as if they had been smudged with burnt cork. This is a purely mountain variety of the female only, and is called var. *bryoniæ*. The other alpine White is a very different insect, though the male, on the upper side, is not altogether unlike the preceding. *Pieris callidice* may be found up to 10,000 feet, flitting over short grass slopes in company with the Ringlets; but it goes at a furious pace when disturbed, and as often as not, when taken, presents a very tattered appearance. On the under side the characteristic green veins are broadened into yellowish shades, while the female, on the upper wings, is, if anything, more like the Bath White (*P. daplidice*), which occasionally appears in the mountains, but is commoner lower down, as, for instance, on the nice bit of hot marshy collecting-ground round Sierre in the Rhone valley.

Every alpine district—and, I may safely say, every mountain and valley in it—has its own particular insects, and it is at first sight perhaps remarkable that the richest hillsides are very often the poorest collecting-grounds. The reason, however, is not far to seek. The hay-harvest in the mountains is continuous, while the worst enemies of the butterfly-hunter are the mild-mannered, amiable cows, who, working downward from the highest pastures as the summer draws on, will eventually graze the whole mountain-side, with disastrous results to food-plants and the larvæ upon them.

As a good example of the devastation a herd may work, I recall a mountain spur above Zinal which rejoices in the significant title of the Roc des Vaches. The side exposed to the sun, where the pasture was fattest, produced practically nothing; but once over the top and down to the rougher slopes away north, all sorts of interesting butterflies put in an appearance. It was here that I made my first acquaintance with the peculiarly Alpine species *Oeneis aello*, which remotely resembles the familiar Grayling (*Satyrus semele*) of our British chalk downs. So far as Switzerland goes, in one year it is only to be taken on the western side; in the next it is confined to the eastern portion. It clearly takes, therefore, two years to pass through its several stages; but what circumstances have caused this eccentricity of appearance can only be guessed at. Possibly it is the result of an exceptionally severe or an exceptionally mild season retarding or developing quickly the ova or larvæ in one region, while the other has remained normal. For I do not find that elsewhere than in the Alps *aello* indulges in this strange partiality. But in any case the division is of old standing, as it is noticed by the earliest observers of the species. The name *Chionobas*, the "winter flier," originally given to the family, conveys a fair idea of the arctic localities it affects; for, though *aello* is the sole mid-European representative, it has several cousins in Norway, Lapland, and Siberia. As a sporting insect—that is to say, an insect which insures a good run over a difficult country—it is without a rival. Inconspicuous in colouring, it is up and away from the rocks on which it sits before the eye can fix its identity; and the high wind as often as not prevailing lends it additional speed, as well as very quickly reducing the wings to shreds. I have never discovered it in any quantity. Single specimens, the worse for wear, run down in the open after a stiff climb, or secured by a chance twist of the net as they whirled down wind and past me, make up the few that

I have myself added to my store; and although I have collected in a dozen Swiss mountain localities, and native collectors tell me it is common enough, I never found it anywhere but at Zinal, so conclude that I must have been in the other places during the "off season."

Next to *aello* I think *Erebia glacialis* the most characteristic butterfly of the Alps. It is the highest flier of all the Ringlets, and, in a way, as mysterious an insect as I know. Where the grass ends, far above the tree zone, and among the wild *débris* brought down by the avalanches of years gone by and the perpetual action of water and frost upon the rock, is the haunt of this beautiful insect. I have taken it as high as 10,690 feet on the Sasseneire above Evolena, on the glaciers themselves beneath the Rossboden (10,500 feet) over Saas-im-Grund, and again at Saas-Fée on the Langeflüh (9345 feet). In July 1900 the dark variety named *alecto* swarmed at Trafoi round the Edelweisshütte on the way up the Ortler; while the ordinary form was equally plentiful at the top of the Stelvio Pass, where the highest carriage-road in Europe winds down in endless zigzags from Italy into the Austrian Tyrol. Sombre are the wings, which in the aberration called *pluto* have lost all traces of the rich brown mahogany-coloured bands and the ocellated spots within them; but, like all the *Erebias* of the Alps, the darkness reflects a splendid iridescence, suggestive of the sheen upon a pigeon's breast. In *glacialis* the gleam is green to brown; in another *Erebia*, one of the largest of the tribe and the most brilliant,—*E. goante*,—it is almost "peacock" blue, like the wing-cases of some beetles. In yet a third, and by far the commonest,—*E. tyndarus*,—we have the actual reproduction of the black-green beauty of the cock's feathers. The reflections, however, are not apparent on the wings of our *Erebia cassiope*, though in some other British butterflies they are present. For instance, the wings of *Colias edusa* (the Clouded Yellow) are often suffused with a deep rosy glow, though the glory disappears with death; and a similar and more lasting brilliancy adorns the Purple Emperor (*Apatura iris*), as well as his Continental brother, *Apatura ilia*.

If you refer to the text-books to find out something of the life-histories of these high mountain species, you will find, in nine cases out of ten, that they are unknown in their entirety, and sometimes altogether. A female will occasionally oblige in the box wherein she is imprisoned; a close search of the grasses growing among the boulders may disclose a batch or a single egg. But the larvæ are not to be found so easily—much less bred. They are night-feeders, and hybernate for the most part in the larval state, which accounts for much of our ignorance regarding their metamorphoses.

Such discovery, however, is the true province of the field naturalist, and even in the life-histories of some of our own little band of butterflies there are still blanks to be filled in by close and careful observation. Minute study and rearing larvæ are hardly possible in a brief holiday, but here I would earnestly recommend to all collectors, whether old or young, the desirability of keeping notes, not only of mere captures, but also of such facts as appear remarkable with regard to the several species taken; for in this way it is that missing links are discovered.

To return to *glacialis*, there is generally the added element of danger in the chase. Like all its race it loves to lop gently over the dizziest precipices, and, once startled, is not easy to come up with, save by diligent stalking. A little experience, however, teaches the wisdom of striking *after*, and not *at*, a butterfly upon the wing, and I have found that the surest method is to keep the sun and wind, if possible, in front of your net, so that the shadow may not disturb the butterfly when it is at rest, nor the wind assist its escape, as it invariably will on a steep mountain-slope. Select the top of a warm sunlit gully, and wait there if, as is probable, insects are ascending it ladder fashion, stopping a moment to toy with the saxifrage and other rock plants, but always working upwards. In this way you will often get far better results than by stumbling over the loose stones and shifting earth which are more sparsely tenanted.

The Alps of Switzerland and Central Europe possess no less than twenty-six species of the genus *Erebia*, but the separation of them as often as not is a matter of great difficulty, from the confusing manner in which one species apparently merges into another. The three highest fliers, however,—*E. mnestra*, *E. gorge*, and *E. glacialis*,—with their varieties, are easily distinguished; while, as an encouragement to the insect-hunter, it may be mentioned that two quite new species have been discovered within the past few years—*E. christi* in the Laquinthal, a valley on the Simplon well known to climbers, and *E. flavofasciata* on the Campolungo Pass, in the St Gothard region, respectively.

The family further affords an interesting field for students of the Darwinian theory that all species have their origin in a common ancestor, and when that ancestor dates from the glacial epoch be sure we shall find something approaching to it in the neighbourhood of the eternal snows. Another butterfly—this time a Fritillary—is a good example of the descent of species. In the Eastern Alps—on the Albula route to Pontresina—and in the Tyrolese mountains of the Brenner, at the highest grass altitude, we may come across an inconspicuous little insect, *Melitæa asteria*, in the company of another member of the family, our Greasy Fritillary (*M. aurinia*. *Aurinia*, subjected to alpine conditions, is a very different-looking butterfly from the gay little species which, though generally decreasing in these islands, is still common enough in some counties. The wing-scales are so reduced in density that the wings have become almost transparent; the scarlet and yellow spots, even in the freshest examples, have "gone rusty"; and to the uninitiated var. *merope* bears little resemblance to the lowland form. In the same way, *asterie* shows much the same peculiarities when compared with relations which appear to graduate through many forms into our rare Heath Fritillary (*M. athalia*). A single mountain climb will often afford a chance of capturing the entire series of connecting links, little fulvous-coloured fellows for the most part, with netted wings; and here, again, in the *Melitæas*, the species overlap and intermingle in such confusion that exactly what is and what is not distinct is still unsettled. Quite recently a new member of the family was claimed for the neighbourhood of the Simplon, one of the best hunting-grounds in all Switzerland, and, though found also near mosquito-haunted Martigny, it bears the name of *berisalensis*, from the little village nine miles up the road from Brigue, much affected by bug-hunters of all nationalities in July for the beautiful blue *Lycæna zephyrus*.

In this species, represented on the Simplon and in the Zermatt valley alone in Central Europe by the variety *lycidas*, we have a remarkable instance of what is called interrupted distribution. *L. zephyrus* is a southern species haunting Russia, Greece, and the Balkan peninsula, and it does not occur farther west. Yet, for some unknown reason, it flourishes in this isolated spot, perhaps the survival of the fittest in a species once common to the Continent. We have a somewhat analogous case with one of our least known Blues, a variety of *L. ægon*, the Silver-studded Blue. The type is common both at home and abroad, but a variety with dingy under-side and much exaggerated ocellation had been named var. *corsica*, as peculiar to that island. A few years ago, however, the identical variety was found to occur in Westmoreland, and the fact is all the more remarkable as there seems to be little in common either in climate or conditions between the rainy county of Northern England and the bright island set in the eternal blue of the Mediterranean. Two other European species at least are separated in this same incomprehensible manner — a lovely Spanish spring butterfly, *Zegris eupheme*, rather larger and not altogether unlike a Bath White with orange tips to the wings; and *Satyrus hippolyte*, of the same family as our Grayling, both of which have not hitherto been observed between South Spain and some districts of Russia.

Alpine insects dearly love moisture. From very few Swiss mountain roads and paths is water altogether absent, and where the runnels have dried up or the rivulet receded, leaving a little sand or mud exposed to the sunshine, there the Blues and the Skippers especially love to congregate. I have seen a patch of warm black earth in the Basses Alpes, where water is scarcer and the torrents soon dried in summer, a moving mass of azure and brown, the iridescent wings gleaming in the sunlight like so many points of fire; and both the higher and the lower Alps are particularly rich in that family, which has ever been a first favourite with collectors. In England we have several beautiful species, notably the

Adonis Blue (*Lycæna bellargus*) and the Chalk-hill (*L. corydon*), which show a kindred taste for mud baths. But the number of alpine Blues is far greater, and each successive zone brings with it a different and characteristic species. Highest of all flies the little dusty grey-blue *Lycæna orbitulus*, by no means easy to distinguish, and protected, no doubt, by the similarity of its colouring to the shaly *débris* over which it flies. I have found it at Arolla, as high up as 9355 feet on the Pas de Chevres; and *L. pyrenaica*, a butterfly so like it that even now the dividing line between the two species is undetermined, occurs in profusion on the Pyrenees up to even higher levels. There are three other species of Blues without which no alpine collection is complete, and they all occur fairly plentifully in suitable localities. *L. pheretes* comes next, I think, to *orbitulus* as a lover of high mountains, and has a special affection for running water and the boggy stretches of cotton-grass by the stream. Easy to distinguish by its under-side—a sort of greenish-grey with two large ovoid dirty white spots—it is unique among its congeners. The brown female is supposed to be much scarcer than the male, but she is of a more retiring nature, less conspicuous on the wing, and flies later than her lord, so that I think it is merely a question of careful hunting and the right time. More brilliant than *pheretes*, which may be described as the colour of blue lacquered steel, is *Lycæna eros*, — a true iridescent azure,—which occurs usually singly by the roadsides; and there is also the very graceful *L. donzelii*, whose brown wings are thickly powdered with silvery blue similar to that on the under-side of our certainly misnamed "Azure" Blue (*Cyaniris argiolus*).

Indeed, nothing is so striking in the handiwork of nature as the multiplicity of shades—which in our poor vocabulary we must needs call by one name—distributed over this lovely genus. Neither description nor art can do full justice to their infinite and exquisite variety, as shifting in sunlight and shadow as the hues of the sea itself. In the Simplon form of the Large Blue (*L. arion*, var. *christi*) the blue surface assumes the black of a thunder-cloud; in another lowland species of the Rhone valley, *L. meleager*, the entire wing of the male is the colour of the heavens on a cloudless day.

There are, altogether, forty-eight recognised species of "Blues" in Europe, of which Switzerland possesses thirty-three, and of these most may be confidently expected upon the mountains in August.

On dull days and towards evening the *Lycænids* may often be found clinging to grass blades and stems, and in this position (usually head downwards) they are by no means easy to distinguish, the sober markings of the under-side corresponding closely to the surrounding tints in the half-light after sunset or when the sky is overcast. A wet day is a misfortune for all tourists as well as collectors, but a dull day is often the more disappointing, because insects, which depend so largely upon the sun's rays to excite vitality, stick close to the herbage and the rocks, and even in some cases (I have noticed this habit on the walls of the vineyards of North Italy in the case of *Polygonia egea*, a species closely allied to our Comma) creep into the crevices of the stone, where be sure the little bright-eyed lizards are on the watch for them. For lizards have a great liking for butterflies, and appear to exercise some such fascination upon their victims as a hawk upon the smaller birds of the hedgerow. I have watched one peering out of his lair, and the great butterfly—it was a Silver-washed Fritillary (*Argynnis paphia*)—gradually circling towards him, until with a dexterous leap he pinned his prey, and four checkered and helpless wings fluttered away on the wind. Protective colouring is very marked in some of the Fritillaries of the mountain-side. When the skies are cloudy you will have some difficulty in separating *Argynnis pales* from the heart of the arnica daisy to which it clings. The warm golden-red of the closed wings corresponds almost completely with the tint of the flower; while the sombre under-sides of the *Vanessidæ* are equally inconspicuous on the brown-red burdock heads which the species largely affects. Most butterflies fold their wings straight up at right angles to the back; our Dingy Skipper (*Thanaos tages*), common enough in the Alps, is an exception, and imitates the Geometer moths, laying the wings flat, while the Skippers of the Hesperid genus—five of which are common to England as to the mountains—elevate the upper pair, but still droop the lower, when at rest.

The most characteristic individual, as it is also perhaps the handsomest and largest of the truly alpine butterflies, is *Parnassius apollo*, and it is rare, indeed, even for people who have no interest in or knowledge of entomology, to overlook it. The flight of *apollo* is the poetry of motion, and, with its semi-transparent wings boldly spotted with black and crimson (rarely yellow) ocellations, and its great moth-like body furred with down, once seen it can never be forgotten. The genus *Parnassius* is also remarkable in that the females are provided with a sort of a pouch beneath the abdomen, and are said to secrete a kind of wax not unlike that of the bee. *P. apollo*, however, at higher altitudes, gives place to the smaller but no less beautiful *P. delius*, distinguished from the preceding by a lesser degree of transparency, and the substitution of a primrose-yellow tint for the white pervading the wings. But recent observations made by Dr T. A. Chapman of *delius* and *apollo* seem to prove beyond doubt that the two are in reality but one species, presenting different features in different localities. There is a legend that *P. apollo* once occurred in Scotland, and, as it is common enough in South and Central Norway, there *seems* no reason why it should not inhabit the Highlands. I say *seems*, because one of the most remarkable facts in the distribution of species, other than the occurrence at widely separated intervals already alluded to, is the absence of certain insects from localities which appear to be in every way suitable to their propagation and development. Apparently it is not always a question of food-plant, climate, absence of natural enemies, or even of elevation. As I have said, many lowland species with us, which do not ascend to the mountains, attain considerable elevation in the Alps and flourish amazingly, just as others which are coast species alone in England, like the Glanville Fritillary (*Melitæa cinxia*), exist far inland upon the Continent. Saxifrage and stonecrop are not rare plants in Scotland; the conditions of wind and weather there are not unlike those of Norway, if the atmosphere is neither as dry, nor the frost and snow so intense and prolonged, as in Switzerland. Yet the fact remains that, despite frequent attempts, I believe both north of the

Tweed and in Wales, to introduce *Parnassius*, the experiment has been a failure. The old records of its appearance in a state of nature in our islands are vague in the extreme; and as *P. apollo* is not a migratory insect in any sense of the word, not even to the extent of the high-ranging butterflies of which I spoke at the beginning of this paper, we may fairly conclude that, while the eyes of those who have reported its appearance may have deceived them in some cases, in others "the addition of the British fauna" has been a stray from the breeding-cage or a chance importation. The pupæ can be had for a few pence from foreign dealers; the rest goes without saying; and the collector who lately ran down *Parnassius apollo* in the neighbourhood of the Shakespeare Cliff, Dover, only possesses a British specimen by virtue of its capture on British soil.

And this leads me to remark that it is a great pity English collectors still continue so largely to preserve the old insular feeling with regard to "foreign" species. Though rich in other orders of Lepidoptera, Great Britain presents a meagre list of butterflies compared with that of other countries. According to the latest authorities, only sixty-five species are admissible as British; and this, I think, still includes several doubtfuls and some which are not indigenous—the Long-tailed Blue (*Lampides bæticus*), the Milkweed butterfly (*Danais plexippus*), and the certainly extinct Great Copper (*Chrysophanus dispar*), which alone of our butterflies was peculiar to England. As against this Lapland alone has sixty authenticated species, France no less than 240, and Switzerland, with which we are mainly concerned, over 170.

The butterflies of the Alps may therefore be recommended to collectors for three reasons: (i) as an assistance to a better knowledge of our own insects, especially helping us to realise that the present lines laid down for divisions into families are by no means settled; (ii) as affording a delightful insight into the great mystery of nature which we call evolution; and (iii) as a pure distraction to give an additional zest to travel, and to provide perhaps in after-days a no less enjoyable memento of holidays well spent in sunny Switzerland and elsewhere.

And now a word about impedimenta. I am often asked what I consider the best outfit for a foreign butterfly-hunt. There are many things to be taken into consideration—space, opportunity, and the desired length of series among them; but, above all, it is necessary that the collector's implements should be handy and compact. I take a folding net of the pattern supplied by M. Graf Krüsi, of Gais, St Gallen, which will fit on to my walking-stick, and, if the climb is not too stiff, do not trouble about another. And now comes the crux—how to store our captures. Collecting only occasional specimens, the best plan undoubtedly is to consign them from the net to glass-bottomed pill-boxes, where they can be closely examined, and, if found incomplete, battered, or of no account, liberated. The boxes (some fifty of them) may be carried in a satchel (I use an ordinary cartridge-bag), the cardboard tops being bored to admit the air, and later on to assist the killing. All boxes filled during the day I place in one large tin box (the cook at the hotel will give you one for the asking) with a small quantity of liquid ammonia, and placing a piece of thin material or paper on the top so as to make the tin edges fit close, leave the insects to their fate. In the morning they will be found dead, and the wings quite supple for setting out, which can be done at leisure, if we have brought setting-boards, and a case for them to travel in.

For collectors moving from place to place such a box—easily made and fitted with cork setting-boards, *unpapered* and with *flat* surface—is essential. On the other hand, many collectors simply kill their butterflies in the net by the old-fashioned plan of pinching them under the thorax, pin them then and there, and either set them out on return to the hotel (in which case the cork of the collecting-box should be kept permanently damp to prevent stiffening) or defer the setting altogether until the tour is over and the specimens brought home in the store-boxes just as they are to England. Another plan which can be recommended, with a little practice, is to place the dead insect in a triangular paper envelope suited to its size, taking care that the antennæ are doubled well back over the head, otherwise they are apt to snap. But I am bound to confess that I have had great difficulty as a rule in relaxing insects preserved in this way, though it is universally adopted by dealers and others who collect on a great scale, and in remoter regions, where packing-space is the chief difficulty. But every naturalist has his own fancy in these matters, and generally believes it the best. Mine, at home as well as abroad, is the pill-box plan, and though it involves more labour on the spot, it has the double advantage of securing perfect specimens, and preventing disappointment later when papers are opened or pinned specimens stubbornly refuse to yield to the influence of the relaxing-box. Very little ammonia (the strongest) is necessary. A thimbleful to one large box I have found sufficient. Two half-pint bottles brought from home have lasted a six weeks' expedition.

The number of butterflies which will not travel quietly when boxed is very small. English collectors except the Wood White (*Leptidia sinapis*); but abroad I have never found it restless, and, so far as I can recall, only one little Skipper (*Carcharodus lavateræ*) bangs wildly about in captivity, though many I have brought home through a long day absolutely without damage. One word further, however, on the pill-box question. Unless space is of no account, large insects cannot be treated thus, and these I pin separately in a tin collecting-box, which should be large enough to carry the pill-boxes in the bag or portmanteau.

In any case, the impedimenta requisite to the chase need not exceed a net, pill-boxes (*ad lib.*), a strong setting-case with a good number of boards (I do not recommend the dealers' stereotyped pattern for foreign travel, as they are too flimsy), a packet of pins (black or white according to taste, of various sizes), and a couple of setting-needles. A store-box and setting-case combined saves room, and, with a little care in giving directions, any reasonably skilful carpenter can knock up what is required. A note-book to record dates, localities, and any observations as to habits of the various captures, will be found of the greatest service when the time comes for disposing them in the cabinet at home.

Some Spring Movements of Sea-Fish.

By F. G. Aflalo, F.Z.S., F.R.G.S.

That there is a general awakening of life around our coasts at this season of the year is well known to all who live by the sea, and both amateur anglers and professional fishermen are once more plying their several operations. Some few of our fishes, it is true, may be regarded as practically stationary within limited areas, but the fingers of one hand would suffice to tally them, and they are without exception unimportant from the economic standpoint. The remainder are a restless race, ever moving from place to place in the great waters, but generally returning to favourite grounds—a feat which, when we consider the density of the medium in which they live and the comparative absence of characteristic landmarks by the way, is almost more extraordinary even than the homing of migratory birds. The migrations of fishes are still very imperfectly understood, but at anyrate much of the old belief in vast journeyings that comprised in their scope the coldest seas of arctic latitudes has been dropped. In its place we have a number of theories, most of which bear the stamp of probability.

Roughly speaking, these migrations of fishes are connected with two primary instincts—feeding and breeding. The fishes do not travel merely for recreation or for change of scene, or so at least we may surmise. The element of "change of air," so strong an inducement in our own migrations, does not enter into their calculations,—if indeed they do not move by instinct merely and not by calculation at all,—for the density and chemical analysis of one part of the Channel or North Sea are identical with those of another: there is the same percentage, in all probability, of dissolved or suspended compounds of arsenic, rubidium, magnesium, manganese, sodium, gold, copper, and many other elements, at Grimsby as there is at Penzance, or at anyrate the difference is so trifling that no fish could be aware of it. The Baltic, it is true, has a very much lower percentage of solid matter, and the Caspian has little more; but few of our shoals, so far as is known, migrate to the Baltic, and assuredly none can find their way to the Caspian.

These particular spring movements must be put down to the dictates of the spawning instinct, for the majority of our sea-fish spawn between March and June. Others, it is true, choose the cold months for that important function, while a few are, on not very reliable evidence, credited with depositing their eggs twice during the year, in early spring and again in autumn. Whether these alleged double-spawners will not eventually be shown to consist of different races of the same fish, as in the case of spring and autumn herring, there is considerable doubt.

If we agree to regard this spring inshoring of the fish, particularly the mackerel, herring, and pilchard, as a preparation for the spawning, we at once eliminate the influence of food; for, as a general rule, spawning fishes do not feed vigorously. One need not necessarily go quite the length of the gentlemen who declare that the salmon fasts absolutely in fresh water until it has spawned; but, on the whole, there is ample reason to believe that spawning fish eat very little. Those who have done much sea-fishing may, with a single exception, rack their brains in vain to recall an instance of their having, on any one occasion, caught many fish on the hook and found them full of roe. Here and there, of course, this may happen, and the writer has at one time or another caught almost every kind of sea-fish that ever fell to his rod with well-developed roe or milt as the case might be. The exception alluded to above, which is here put forward with some diffidence, is that of certain flat fish, notably the plaice and dab. Both of these he has caught on hand-lines in moderately deep water, and full of spawn almost ready for shedding, so frequently that it seems impossible not to view this singular sub-order (*Heterosomata*) as an exception in this respect, as it is in so many others.

After the object of these spring wanderings has been decided—it has not, as a matter of fact, been decided at all, but opinion is very strongly in favour of viewing it as a spawning movement—the next interesting aspect of these travels is their direction.

This is, with the majority, from south-west to north-east, the first mackerel being taken in very early spring off the south-west coast of Ireland; then shoals gradually appear farther and farther east along our own south coast, beginning with Mounts Bay and progressing past Mevagissey and Plymouth to the easternmost Channel grounds at Hastings and Dover. Most fish, that is to say, move inshore to spawn ; but a few, like the sole, move farther out to sea. What may be the precise objects in either case it is not easy to say. It is clearly not true that the sole moves out into the deeper water in order that the increased pressure may help it to get rid of its eggs ; for it would, if that were necessary, be unable to spawn in the shallow tanks of the aquarium, which it has nevertheless been often known to do. If there is a sea-fish to which this necessity for a deep spawning-bed applies, it is not the sole, but the conger eel, and on that necessity, I suspect, rests all that there is of truth in the theory that the conger spawns once and then dies. Death, it is true, overtook some female congers in the Plymouth Aquarium, but they were in a wretched state, and quite unable to discharge their eggs under the conditions of their captivity. Therefore, somewhat hastily, I think, it was declared that the same fate would overtake them in nature, and this in spite of the well-known fact that their natural breeding-grounds and the haunts of the developing *Leptocephali*, as the larval stages are called, lie in the deepest parts of the Mediterranean, and doubtless also of other seas as well.

It is, in fact, quite impossible in our present limited knowledge of fish life in the seas to lay down any rule that shall cover every case. We may argue that the sole is sensible in depositing its floating eggs in the offshore waters, since the ferment of the breakers, particularly in rough weather, would seriously prejudice their already slender chances of development in the shallows ; but the same objections would apply with equal force to all the fishes that successfully deposit their eggs close to the land. We may equally endeavour to draw some line of distinction between the majority of the fishes which lay floating eggs and the minority (including the herring) which lay eggs that sink; but the facts are too strong for our theories, and we shall find, on honest examination of the evidence for and against, that some of the "demersal" (*i.e.*, heavy) eggs are laid almost above low-water mark, while others are deposited some miles from dry land. Nor is it possible to find any constant relation between the migratory fishes and those which deposit these same heavy eggs. It was formerly argued—ingeniously, but on insufficient evidence, as later research soon showed—that the fishes hatched from heavy eggs were more migratory than those hatched from floating eggs, since much of the necessary dispersal of the species was already accomplished in the latter case by the drifting egg itself. This argument was invariably illustrated by the case of the migratory herring and its demersal egg. On the other hand, it was afterwards discovered that the mackerel, fully as restless a wanderer as the herring, came from a floating egg. It is not therefore surprising to find that the mackerel has a much wider distribution than the herring, the former being more or less confined to the cold and cool seas of the northern hemisphere, the mackerel ranging into warm seas as well.

In conclusion, a word of caution must be added in respect of the commonly accepted theory of a general spring migration among our sea-fish of all kinds. Within certain limits this is no doubt the case. At the same time, the warming of the sea close to our coasts is the sign for renewed activity not alone among the fish themselves, but also among the smaller longshore fishermen, the very class from which inquirers would be more likely to draw their information than from the less accessible deep-sea trawlers or liners. There is thus the risk of confusing with the genuine migrations of the mackerel and pilchards and whiting a series of smaller movements among the flat-fish and pout, which consist rather in once again showing an interest in the baits offered them. One more genuine migrant occurs to mind, and that is the bass. During the middle of April, and more conspicuously in the early days of May, the shoals of bass once again make their appearance in the Exe and Teign and other south-coast rivers, and once again, in early autumn, they will disappear as regularly and as completely as the swallows. We know where the swallows go, but the winter quarters of the bass and also of the bulk of our mackerel no man knows. Once they pass outside of the zone fished by our drifters and trawlers, they vanish completely out of our ken.

Reptile Studies.

By Gerald Leighton, M.D.

III. SPRING—THE SEASON OF RENEWED FUNCTIONAL ACTIVITY.

In our last issue I drew attention to the remarkable condition of our reptiles in the winter season—viz., the state of hibernation. We have now to turn to the consideration of the more general points observable by the field naturalist during the season of spring, or, as I have termed it above, the season of renewed functional activity. The transition from winter quiescence to spring growth is striking enough in all branches of biology, plant and animal alike, but in none more so than in the group of reptiles, because here, to all appearance, the change is abruptly sudden. I say, to all appearance, because doubtless the reappearance of the snakes and lizards is preceded by a period of preparation, whilst as yet the reptiles themselves are still hidden away in their hibernating quarters. The functions of respiration and circulation gradually regain activity as the days become a little warmer, until such a temperature is reached which induces the animal to seek the outer world once more and commence a search for food.

The exact dates at which the period of hibernation commences and finishes depend upon three factors mainly, viz.:—

1. The particular locality under notice.
2. The species of reptile.
3. The severity or mildness of the particular season.

Thus in the counties of Dorset and Cornwall adders are, as a rule, found active towards the end of February, whilst in the central and northern parts of England, as well as in Scotland and Wales, the usual time of their reappearance is towards the end of March or early in April.

Secondly, The different species are variously affected by temperature. The adder stands cold better than the harmless ring snake, consequently is encountered astir a little earlier in the spring. In the same way I am inclined to think, from my own observation, that the slow-worm becomes active rather before the common lizard; but I should not like to be too dogmatic on this point, as the little *Lacerta vivipara* is very apt to escape observation as compared with the more prominent *Anguis fragilis*.

Thirdly, The character of the particular season has of course a determining influence on the date of the appearing of the reptiles. In a cold damp spring it may be as late as May before any are observed. Such a spring was that of last year (1901), when in Herefordshire the first adder I saw was on May 16, quite a month later than usual. This year I obtained my first spring adder on March 10, and another four days later, both of them being males, a point to be referred to again.

There is a fourth consideration which I have observed to apply to adders, and that is, that the period of hibernation is longer in old adders than in young ones. In other words, the reptile-collector will find that the majority of the first few adders taken in early spring will consist of the young males.

The question of sex seems to play an important part in the movements of reptiles in spring. If a collection of adders were made with specimens taken solely in the spring months, the males would be found to preponderate very largely. In fact, it is quite exceptional to take a female adder early in spring. A little later, in June, both sexes are taken in about equal numbers and frequently together; whilst in the autumn months the females are much more in evidence than the males. Thus a collection, to be representative of the true proportion of the sexes in any given locality, must be the result of work from early spring to late autumn, otherwise misleading conclusions will be arrived at.

The inhabitants of the New Forest, Hants, have a saying that "adders are fattest in March month." When the reptiles first become active after the winter, the first thing they do is to cast a slough, and next they set about making up arrears of food as soon as possible and with great activity. A snake at the end of the hibernating period is a very attenuated object indeed, but two or three weeks make a wonderful difference, and by the end of March they are usually quite plump and in first-rate condition. At this time it is no uncommon thing to find two or three mice in the stomach of adders, and the ring snakes gorge themselves with tadpoles and young frogs as soon as the latter are obtainable. An early visit to a pond in a neighbourhood where ring snakes occur will generally find them busy feeding, capturing their food often in the water, but bringing it to land to devour. Seven o'clock in the morning is perhaps the best time to see this, while the dew is still on the grass and the sun's rays are not yet powerful. The adder feeds from daylight onwards, but passes the heat of the day digesting and basking in the sun. Amongst the lizards, the slow-worm prefers to feed soon after sunset, or at any time of the day after a shower of rain. The favourite food of this lizard is the common slug, of which the slow-worm consumes vast quantities, and as the slugs are most active in the evening and after rain, it arranges its meals accordingly. An extraordinary sight it is to see a ring snake devouring a frog, the anatomical arrangements of the jaws allowing ot immense dilatation, but the process is too well known to need any description here. Very interesting to watch, also, is the slow-worm feeding. The slug is seldom taken unless it is moving. The slow-worm gradually approaches, poises its head in a delicate curve just over the slug, then with a quick movement seizes the mollusc by the middle. There is then a period of a few moments during which the reptile remains motionless; the slug meanwhile contracts and exudes frothy bubbles. A sudden wide gape of the jaws —as far as the fixed jaw allows of distension—and the slug disappears head-first down the slow-worm's throat, to the accompaniment of gaping and licking of the jaws on the part of the slow-worm. I have seen a slow-worm in one of my cages devour a dozen slugs one after the other at an evening meal in this way. A few of these reptiles in a garden would materially assist the gardener if he could only be persuaded that they were not venomous serpents, and could be induced to refrain his hand from battering these most harmless creatures to death on every possible occasion.

All our snakes and lizards cast their sloughs in the spring, but do not make a meal of them afterwards, as some amphibians do. Whether the slough is cast whole or in several pieces depends, in my opinion, upon the circumstances of the reptile at the moment. The casting off is a mechanical process, and the very delicate slough is easily torn by any protruding point against which the animal happens to come in contact. The eye-scale, which in the snakes does duty for an eyelid, is cast along with the rest of the slough. After the sloughing is completed the reptile is very active, and generally proceeds to feed at once; while for a few days previous to the sloughing no food is taken, and the snake or lizard is torpid and sulky.

At the end of spring pairing takes place, and soon afterwards the oviparous species deposit their eggs, concerning which we shall have something to say in our next number.

The season of spring, then, is essentially one of renewed functional activity. The processes of respiration, circulation, digestion, secretion of venom, and sloughing, all of which have been in abeyance during the long winter hibernation, are once more in full activity, and the field naturalist who turns his attention to the reptile group will find plenty to observe and study.

May I close this article with an appeal to all readers of this journal to use their influence with those with whom they come in contact to secure freedom from persecution for our harmless British reptiles. It cannot be too generally known that only one—the adder—can under any circumstances be dangerous, and if all who employ gardeners, game-keepers, farm-labourers, and other servants would impress this fact upon them, something might be done to spare far more of these wonderful and beautiful creatures.

Entomology in Spring.

By Claude Morley, F.E.S., &c.

Now, now, when all the world is young, I would rather be a Naturalist than—anything! The pure mental and sensual joys of the wild untrammelled country, when it is bursting everywhere into flower, life, song, and being, are delights worth existing through every long dreary winter to experience; and these only the true Naturalist—he who, knowing a little, can appreciate the magnitude of that which is changing around him, in themselves common annual events usually unnoticed and ignored—is capable of assimilating to the full. What more glorious than to stroll through the woods in May, when the sibilant hum of the hoverer flies mingles with the deeper boom of the bumble-bees among the ground-flowers; when the fluttering song of the larks rises above the chirrups of the nesting hedge-birds; when the fritillaries swoop across the bushes and dandle for a moment above the hyacinths between them. The leafing trees give off delicious scents, responsive to the new-found warmth of Sol, and all the earth is gay and bright with the wakened sweetness of a season come.

Insect life is in full swing, and on every hand the entomologist will find species he is sure to want. The mere collecting of these lovely atoms is a thing to be deprecated; the object of a collection is purely that one may be able to recognise and *learn* how the gamut of Nature is attuned in this especial branch—one so numerous in species that those already described equal nearly the whole of the other sections of the world's fauna rolled together. To the thoughtful mind this statement implies two things: the one is, that a complete collection indicates that of half the known species of the Animal Kingdom, but it will be obvious that a complete collection is as impossible as that of the moonbeams; the other, that to effect its compilation such destruction of life would be essential that one may well pause and inwardly ask if he be justified in so colossal a slaughter, even in the cause of science. The time, I sincerely believe, will come when private collections will be a thing of the past, as indeed they are already becoming in London, and when all scientists will expect to find in the national collection in the British Museum, if not in the museum of their own towns, sufficient material respecting their own particular study to satiate the most exacting.

In 1896 a well-versed entomologist computed the number of British insects alone to be nearly 15,000 distinct kinds, and no doubt remains that this estimate is decidedly under rather than over the truth.

I mention this here because one is tempted by the swarming horde abroad on this May morning to imagine that their name is legion, and that no computation of their numbers is possible; but by far the majority, at least in Britain, is classified and known. It is useless to indicate where to look for insects in spring; they are, as Edward Newman has said, found "not only from the topmost twigs of the tallest trees to the very surface of the earth on which we tread, but also above the trees—far, far above the tree-tops, even in the air itself: far, far below the surface of the earth, even in the deep caverns, dark and dank, which seem thoroughly designed for avenues of another world."

Still, most insects, when we come down to individualise, have their favourite haunts, many of them as curious as they are unexpected. Who would look for rare beetles running about the edges of brackish ditches and pools near the sea-shore, yet never entering the water nor roaming far from its margin; or again, living out an apparently desolate existence in the tombs of our ancestors, blind where no light comes, yet carrying out all the functions of their state as fully and exactly as does the most frivolous butterfly or demurest dormouse? But it is upon the open moor, in the voiceful woods and the fragrant meadow-lands, that insects most do congregate; and one naturally wonders "whence came all this glorious band." A large number of them, as I pointed out in our February issue, have hidden their beauty away in deep places during the dark days of winter, and are now crept forth to the renewed heat of spring to complete their life's work of reproduction, which could not have been accomplished earlier, since there were no succulent shoots on which the caterpillars, soon to emerge from the egg-state, could subsist. But the bulk of them are new-born from their chrysalides, which have been of two sorts. One is helpless and often immovable; the other is capable, by the aid of lateral hooks and other interesting appendages, of considerable locomotion. The pupa of the Goat Moth, for instance, so destructive to our well-grown timber by boring long galleries into its solid wood, wriggles along its tunnel, from the deep interior where it has passed the winter secure from frost and foes, to the surface of the tree, whence it may often be seen protruding some inches after the escape of the perfected moth.

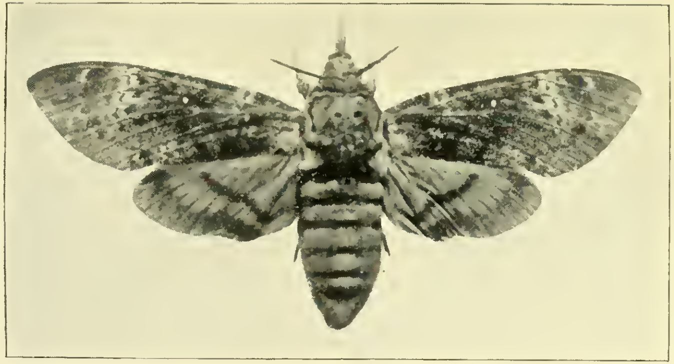
The methods by which insects are now liberating themselves from the more or less dense cocoons which have protected them from the rigours of the elements and the attacks of enemies during hibernation, is a wide and most fascinating study, rendered the more interesting since the efforts of the captives are by no means always rewarded by success. When the full-grown caterpillar changes to a chrysalis, the skin of the former splits open, and the fully formed pupa is at once revealed within, though soft and white. As already mentioned, chrysalides are of two kinds, known as hemi- and homo-metabolous. In the latter the pupa in no way resembles the future insect, and the metamorphosis is complete; in the former all the organs are already visible, though swathed in transparent sheaths. Homometabolous pupæ often construct no cocoon, since their own integument is sufficiently stout, but the hemimetabolous are always further incased in such an exterior covering. These latter, which are mainly beetles and the bee tribe, are furnished with stout teeth, with which, when spring is come, they are enabled, after slipping off the sheathing, to gnaw through the cocoon and so reach the wide, wide world of light, air, and sunshine. But moths, which, though homometabolous, very often spin cocoons, and sometimes very tough ones too, have no teeth but only a proboscis for sucking liquids. How, then, do they pierce this outer vallum?

Let us take, as example, the strangest case of all—that of the Puss Moth. I have studied the life-history of this insect pretty closely,[1] but was not chemist enough to tell how the perfected moth contrived to escape from its cocoon, which is kneaded by the caterpillar's salivary glands from chips of wood and sawdust into the consistency of virgin wood, and is so hard that a really strong knife is requisite to impress it. Mr Oswald Latter has subsequently, however, pointed out that the chemical secreted by the perfect insect is so strong a solution of potassium hydroxide that it actually melts this solid case, and the moth quietly stalks forth through the hole thus effected. Many beetles too, when they come to maturity, find themselves so deep in timber that they have literally to eat their own way to freedom; and I have recently heard of a Wood-boring Wasp which found itself in the "roller" of a piece of cloth. Nothing daunted, it gnawed clean through the whole "length," much to the detriment of the latter, and on another occasion to that of a boy's purse, whence the prisoner won its way through two thicknesses of leather! But these species, possessed of jaws, such as the Goat Moth's caterpillar, which will burrow through anything from lead to seasoned mahogany, could not effect such prodigious feats if not assisted by softening chemical fluids.

Every spring brings its little fairies, but how many does it leave behind it! As eggs and caterpillars thousands are destroyed by birds, as pupæ other thousands by mice and moles; then, having attained a perfect state, they are still attacked by bats, nightjars, and the ruthless hand of civilisation, which, arrogating to itself artificial methods, loudly declaims when it finds Nature—in which all things work together for good—still keeps the even tenor of her way. The Leather Beetle, which removed obnoxious carrion, preys upon our tanneries; the Turnip-Flea and Cabbage-Butterfly, which kept *Cruciferæ* in check, infest our vegetables; Tiny Moths, which demolished outworn birds' nests, attack my lady's furs; and Bot Flies still drive mad our poor half-tamed herds of deer and oxen, as erstwhile was their wont when lordly droves of their progenitors roamed free through forest, fell, and ford.

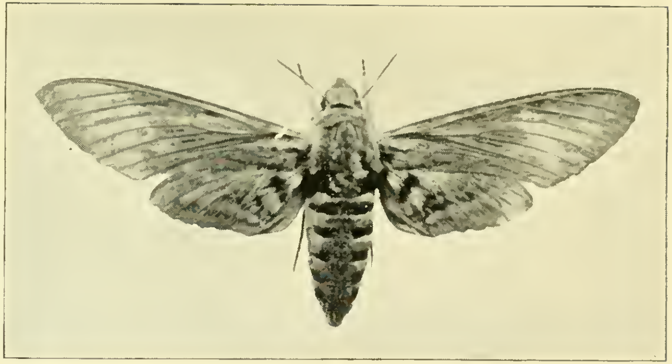
---

[1] Cf. 'Science Gossip,' 1893, p. 38.

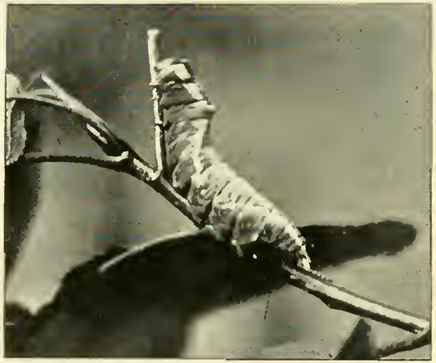


Photos by J. Peat Millar.

Death's-head Moth.

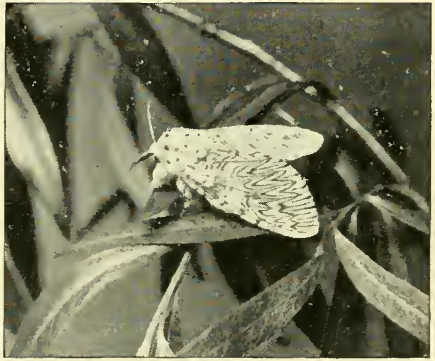


Convolvulus Hawk Moth.



Photos by T. Dewhurst, Preston.

Larva of Puss Moth on Poplar.



Puss Moth on Willow.

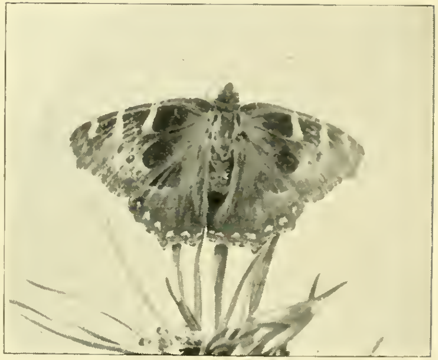


Photo by J. Peat Millar.

Small Tortoise-shell Butterfly.

Moles.

By Oxley Grabham, M.A., M.B.O.U.

Moles are far from being the uninteresting little creatures that most people consider them, and a great deal of pleasure and instruction is to be derived from a close observance of their habits and structure. Wherever one goes in country districts one soon encounters evidences of moles in the well-known hillocks of soil that these animals cast up, not only on low-lying land, but also on the top of some of our highest hills; and in every well-regulated locality the familiar figure of the mole-catcher is to be seen, with his spade, bag of traps, and his bundle of hazel or ash sticks. Sometimes he is mounted on a stout rough pony, at others he foots it along from village to village. It is not a very lucrative profession that of the mole-catcher, 3d. per head or so much per acre being the usual price paid; but it is at least a healthy outdoor life, if care be taken—as it usually is—to avoid getting wet from the constant kneeling on the ground. Most mole-catchers guard against this by wearing thick leather knee-pads. It is beyond the scope of this article to describe the various kinds of mole-traps—their name is legion. Some prefer those made of iron, working by springs; others pin their faith to wooden ones working by a bent ash or hazel rod. Our immediate concern is rather with the habits of the mole.

As most people are aware, the fortress of the mole is most cunningly constructed, with many passages for escape in case of any danger threatening the owner. From this fortress runs are made in all directions in search of food, and the hillocks or molehills that we see everywhere are the superfluous loose soil thrown out by the little animals *en route*. This fortress is generally situated at the bottom of a thick fence, or at the foot of a tree. In an old fortress the female generally produces her young, sometime during the month of May. I have dug out many nests, and have found them nearly all to be made from the oak or the beech leaves, and the roots and stalks of grasses, generally those of the dog-grass, known in the country as "wicks" and to science as *Triticum repens*. The leaves form a warm lining, and are often bitten into small pieces. I have never found more than four young ones in a nest myself, but I have occasionally heard of five. When about half-grown these sleek little animals are very pretty. They keep close to the nest at first, seldom straying far from home. They are fond of coming above-ground when they get a chance and everything is quite quiet, but when suddenly surprised cannot of course burrow out of sight either so quickly or to such a depth as the old ones. I once kept a mole alive in a tub half filled with earth for some weeks; but the animal was such a ravenous feeder, and required such a tremendous quantity of worms to satisfy its hunger, that I was by no means sorry to let it go.

For some years I have been collecting varieties of the mole, and have accumulated a small but very interesting collection of white, sandy-coloured, piebald, blue, and slaty specimens; but I have never yet succeeded in obtaining one spotted or dappled with white, though I have seen one or two such in other collections. Now, it is often said that these varieties are found only on certain geological formations, but I think that this has very little to do with the distribution, as my specimens are from the most varied districts. One curious thing I have noted, namely, that where one variety is taken another may be looked for with a fairly good chance of success—so much so, that I know of one place in Wales from which sandy-coloured specimens have been sent to many museums throughout the country. On the other hand, in other districts where thousands of moles have been caught in the course of years, not one single departure from the ordinary-coloured type has ever been noticed.

The names by which the mole is known in Yorkshire are —moudies, moudiewarps, moldards, and nunkeys. From the last name the hillocks are termed "nunkey-tumps." Some years ago there was a dispute about some land in a certain locality, and several old fellows were put into the witness-box. One of them on being asked by a very well-known barrister—since dead—what he knew about the field in question, replied, "Why, it's a rare close for nunkey-tumps." "My good man," inquired the barrister, "what on earth do you mean by 'nunkey-tumps'?" "Why," said the old fellow, "tumps made by nunkeys, for sure"—and this was all the information that could be got out of him until some one acquainted with the dialect explained matters.

Moles can swim well if necessary, and in flood-time may often be seen making their way from one mound to another; and I have known them take a dive into a stream and enjoy a swim of their own accord.

They are preyed upon by foxes, stoats, owls, and occasionally, I believe, by the badger and the rat; but I believe that it is but rarely that the weasel will take them. Weasels are taken at times in the mole-traps, but they are generally pursuing field-mice, which use the runs or galleries of moles a good deal.

One often hears the question discussed as to whether moles do much damage to the land or not. The verdict is usually given against them, but except where they are in great numbers I believe they do good. They help to drain the land, and they rid it of many noxious grubs and insects; and if the earth constituting the mole-hills were only spread about the ground, it would also help to manure it. When in great numbers, of course they do a considerable amount of damage. The meadows are defaced, the growing corn is uprooted, and the young turnips amongst which the moles have been working die away in a hot sun from having the soil at their roots loosened.

In the summer moles may often be found above-ground, and during the warmer months their runs are frequently close to the surface. In the cold weather their prey—worms, &c.—go deeper down into the ground and the moles follow.

The wonderful spade-like forefeet of the mole, with their powerful muscles and ligaments, are most admirably adapted for their life under-ground. They have the sense of hearing most wonderfully developed,—the slightest noise or the vibration from a footfall, and they are off at once. It is generally admitted that the mole can see but imperfectly.

The eyes are very small, and the lens is without a nucleus, and without concentric structure. Light can pass, but it can hardly form an inverted image, and would appear at most as a tangle of lines.

Some dogs are very quick at catching moles which are working close to the surface of the ground, so also are some cats. I once had a retriever which caught numbers in this way. Moles possess a peculiar musky odour which, when one is skinning them, is far from agreeable, and they swarm with parasites. And as a final peculiarity I may mention that I have never heard a mole utter any sound except when injured or taken hold of.

Norfolk Broads in Spring.

By Rev. M. C. H. Bird, M.A., M.B.O.U.

It is now nearly a month since Lady-day, and so, in spite of the penetrating keenness of the easterly wind, it must be spring-time, although there are as yet but few signs of fresh vegetation in the extensive stretch of marshes before us, save where the adder-carrs are warmly aglow with sunlight, reflected from their purple-grey buds and same-coloured twigs of the previous year. There is a tinge of yellow too in their expanded catkins, but not so conspicuous in the distance as that arising from the "palm" of the sallow-bushes. As yet there is no trace of greenery in the reed-beds, and the sedges of last year's growth still protect and hide, under a dense tangled mass of brown, the close-folded spear-shaped leaflets which are waiting strength to thrust themselves through their winter coverlet. The storms of winter have whipped out all the chlorophyll from the pin-rushes which once formed the carpets and candle-wicks of our ancestors. People are still living who used to gather and peel them for "rush-lights," and some of our parishioners still exercise their right of cutting a thousand turves or hovers from the common; but the old open hearth is practically a thing of the past, and the ubiquitous coal-cart is an enemy of peat. The 1st of May is, however, entered on the minutes of our parish meeting-book as the annual date upon which "hover-cutting" may be commenced. An unwritten law forbids the cutting of reed before Christmas and after the 16th of April. But the humble-bees on the willow-blossoms and a solitary sulphur butterfly which has just danced by remind me of digression from my subject.

Let us step into the punt and look for further signs of new life. There on the bank are a pair of the delicate Yellow Wagtails, never so brightly coloured as upon their first arrival from Africa, and close by some fresh blossoms of the Marsh Marigold have now taken the place of the few surviving blooms which this hardy plant always manages here and there to maintain during a mild winter. Moreover, the accumulated temperature has been sufficient to hatch the frog-spawn, and the ditch in which our boat lies is full of these marvels of amphibian life, locally called "spot-spoons." Their careless parents have for the past few evenings commenced to rejoice in the unstopping of their lips, for during hibernation it is popularly supposed that "their lips are gummed up, and if you force 'em open they will die directly." But more curious than this fallacy is the fact of Frogs and Toads croaking *after* and not before or during the breeding season, a habit which, so far as I am aware, has no counterpart in British wild life. The Vipers, too, begin now to leave the dry banks around the broad and to seek their food upon the marshes, where the beautifully veined but odourless Marsh Violet has already opened its lowly petals to useful guests, for several insects are upon the wing. A precocious May-fly clung to our coat-sleeve just now as we pushed through the reeds, and a specimen of the antlike beetle (*Pæderus riparius*), fairly numerous hereabouts, was discovered in the litter in the boat a moment ago.

That great splounce in the water yonder, with its subsequent miniature whirlpool, reminds us that the pairing-time of the Pike has come, and those who at this season of the year take a mean and poaching advantage of the love-making of this fish, know well how far the word "pairing" may be applied to their April habits. The spawning of Pike does not take place simultaneously. The smaller fish shoot their roe first, but, as a general rule, for some days previously both they and Perch swim in pairs, and in former days at anyrate many couples were taken "with a little bit of lint" (*i.e.*, net) from their favourite haunt or hole. Now, too, is the time when Pike run up the ditches communicating with the broads and rivers, and many a fish has by thus rendering itself more than usually conspicuous fallen a victim to impromptu boot-lace, or a carefully smoked copper-wire, snare.

But we have now crossed the broad, so will take a glimpse over Swimcoots wall and see what the fowl are doing in the slad: lie low, and have your glasses ready as the boat drifts up to the shore, for the noisy Redshanks will soon betray our whereabouts, and should a great grey harnser be standing anywhere near where the boat runs aground, we shall not have much time to inspect the aerial concourse which will immediately follow his resonant "Frank! Frank!" Look, there are three gaunt Herons all close together, and another a few yards away, all motionless as statues. "They are after the eels and frogs now the water has gone down," says our boatman, but we do not see that they make any attempt to feed. A soft and gentle "wheöh, wheöh," attracts our attention to a bunch of Wigeon, and a beautiful old male, with lovely pale buff occiput and pure white speculum, raises himself up, treads water for a second, meanwhile flaps his wings, and strokes his breast with his beak. Three marbled Shoveller drakes and one female tell the tale that their domestic difficulties have commenced, and a pair of Garganey Teal raise the wish to our lips that they may remain to nest; for, from some inexplicable cause, this species has decreased here just in about the same time and proportion as the Shovellers have increased.

The unexpected happens, and neither Redshank nor Heron is responsible for spoiling our picture; but the playful gambols of some half-dozen colts, freshly turned out, disturb the Herons, and they, once on the wing, soon give the alarm; so, after crouching still for a few seconds, we stand upright to watch the rising medley of bird life. A very few moments suffice for the assembly to sort themselves according to their species, and we meanwhile notice the differences in their flight and actions, and—as they pass over our heads—the perceptibly larger size of Garganey over Common Teal. After one or two circles over their former resting-place, each circle greater and loftier than the last, the Garganey go right away together, and the shovellers also make off to another part of the broad; but the Wigeon and Common Teal, not nearly so wild now as in the winter, seem disinclined to leave the spot, some few indeed dropping down within a hundred yards of us, some nearer still, giving us the opportunity of seeing whence those wing sounds proceeded which we tried to locate and identify at evening flight here some four months ago.

We wait until the musical Redshanks and mournful Peewits have resettled and then step ashore. In doing so we note a bright green grassy mound enriched by the ichthemic guano of the Otter, and close by we find some of those curious pharyngeal teeth of the Tench which enable it and other weed-feeding fish to masticate their food to such an extent that the *incognoscenti* are apt to mistake their droppings for the dung of birds. Scarce are our heads above the bank-line ere the Wigeon are up again, and this time settle upon the open broad. Five or six Mallard too rise singly but not simultaneously from the rush-clad splashes around the larger slad. Their mates are sitting on the inside marshes or even upland perhaps, but as soon as their ducklings are hatched they will lead them straight down to the edges of the broad, and until well able to fly they will not betray their presence to human eye. It is indeed wonderful how both an old duck and her young manage to conceal themselves from observation. Even when able to fly, after sunset is the only time when they thus progress, unless a very wet or windy day makes them restless: thus perhaps is the fact accounted for that summer visitors here see so few wildfowl before the end of July, many flappers indeed being able to fly strongly by the 1st of that month, although the parent birds may not have recovered from their moult.

Once on the marsh, we cannot restrain ourselves from having a look for eggs, if only on the chance of coming across some abnormal specimens. The colour-markings and size of the eggs of the Common Plover, Redshank, and Snipe vary considerably, all being usually both handsome and attractive. These three birds, if disturbed whilst sitting, leave their eggs in the order named. The Plover, building quite an open nest, is very shy, and sneaks off at the first sign of danger, whilst the Redshank and Snipe, though about equally well concealed by the tussock containing their nest, are not equally trustful in remaining on their eggs, possibly because the Redshank frequently builds in a solitary tussock, whilst the Snipe always chooses a site in which the surrounding vegetation is of equal height and denseness.

Some readers may take exception to my writing of the *nests* of the Plover. These may in certain localities, perhaps, be correctly described as mere "scrabs," and so they are here sometimes until *the first egg is laid.* But subsequently more short pieces of grass and rush are added, especially in wet situations, and I have frequently taken a good double handful of stuff from a full nest. So protectively coloured are the eggshells of these three species that to a novice they are very difficult to find. Plovers nest with us in decreasing numbers. Thirty years ago the drier marshes near the coast, practically useless for agricultural purposes and given up to rabbits, used to yield a sort of catch crop in the shape of plover's eggs, which were systematically gathered, and many a day's compulsory apprenticeship have I served amongst them in bygone Easter holidays. Every foot of ground had to be inspected, and for this purpose the searchers formed a line and kept it, carefully, slowly, and methodically tramping up and down until every marsh was examined. It was not bad fun at first, but soon became wearisome.

In these latter days of decreased variety of bird-life, protection by law, and preservation by individual effort, seem at anyrate likely to prevent any further diminution in the number of species which breed here, if indeed one or two species may not be tempted to return to their former spring quarters. Ruffs and Reeves still visit us annually, and a few have already put in an appearance this month (April). Some years ago I was singularly fortunate in making a close acquaintance with several examples of this curious bird. It was a lovely day, and I had taken a friend over to Hickling on the off-chance of seeing one, and we were lucky enough to have eight almost full-frilled Ruffs and three Reeves within 15 yards of our boat for nearly half an hour. It was a never-to-be-forgotten sight, but space precludes a description of their plumage or their antics, and we must reserve for a future occasion the consideration of other spring and summer visitors to Broadland.

A Field Naturalist's Diary for 1901.

By W. Percival Westell, M.B.O.U.

(*Continued from p. 44.*)

April 1st.—The wryneck was heard and seen near St Albans to-day.

4th.—Saw wheatear in brownish plumage, apparently a female, and noticed particularly the dipping flight.

5th.—Strawberry-leaved potentil, red dead-nettle, and daisy in flower; hawthorn bursting in places. Saw a golden-crested wren—a somewhat rare bird with us.

7th.—Lilac unleafing; lesser celandine in flower to greater extent now; horse-chestnut bursting. Heard the chiffchaff for first time.

13th.—Currant leaves opened, also nutmeg-tree; almond in blossom; wallflowers bursting; lilies of the valley through; daffodils in bloom; crocuses going off. The season is about three weeks late.

14th.—Heard willow- and wood-warblers, nightingale, tree-pipit, all for first time. Wild rose leafing. Many nests with eggs now. Greater stitchwort showing, but not in flower yet; blackthorn in leaf.

20th.—Cuckoo heard. Shepherd's-purse in flower. Saw two swallows. Catkins of aspen and birch prominent.

21st.—Dog violet and white violet in full bloom. Flowering currant, greater stitchwort, plum, blackthorn, all noticed in flower for first time. Garlic mustard bursting; spruce fir cones noted; elder right out; larch fir greening. Ladybird seen; small tortoiseshell and large garden white butterflies on the wing. Green woodpecker noisy. Heard blackcap first time. Field mice out. A friend saw a robin without a beak and another one feeding it! Saw two sparrowhawks, and heard the kestrel's love-song. Lichen and wool are often found on the same trees, an occurrence which is very useful to the chaffinch in searching for nesting materials.

22nd.—Temperature 94° in the sun. Coltsfoot in flower —very late for first occurrence.

24*th*—Brimstone butterfly on wing.

25*th.*—White arabis a mass of blossom; white dead-nettle and yellow rocket first noticed in flower.

28*th.*—Heartsease, ground ivy, goldilocks, hedge parsley, wild cherry, all in flower. Herb Robert conspicuous, but not in flower yet. Greater whitethroat seen and heard; heard turtle-dove; many nightingales in full song.

30*th*—Lime and horse-chestnut in leaf.

May 2nd.—First wasp seen.

3*rd.*—Hop trefoil, shepherd's needle, and dove's-foot crane's-bill first noted in flower.

4*th.*—Delighted to see a goldfinch in my garden; this bird is increasing in this district. It is now protected all through the year.

5*th.*—Oak leaves just showing. Cuckoo-flower, garlic mustard, wood sorrel, cowslip, wild hyacinth, wild strawberry, marsh marigold, and maple all seen in bloom for first time. Saw house-martins. Dog's mercury seeding; apple blossom bursting; plum going off; cherry and pear in full bloom.

7*th.*—A song-thrush's nest with *six* eggs in, found by a friend in a furze bush: the more usual number of eggs is four or five.

11*th.*—A hedge-sparrow's nest was found built in a cabbage!

12*th.*—Saw first swifts. Found heron's nest with five eggs, three being duly hatched off, an interesting county record. A magpie came into the tree whilst I was watching and pried round the nest. Peacock butterfly on wing.

16*th.*—Ferns fronding rapidly.

18*th.*—Cuckoo-pint, yellow dead-nettle, and herb Robert in flower.

19*th.*—Orange-tip butterfly on wing. The increase in number of the greater whitethroats is very noticeable. Many more song-thrushes' nests than blackbirds'. Saw a young goldfinch; this is rather early. Ring-dove sitting. Great many turtle-doves in the district this year.

22*nd.*—Long-rooted cat's ear in flower.

25*th.*—Bird's-foot trefoil, broom, pink campion, wild guelder rose, red clover, cow parsnip, mountain ash, and bush vetch noted in flower for first time.

26*th.*—Lesser spotted woodpecker heard drumming. Found robin's nest containing six eggs in an old water-can, two of the eggs being pure white. White campion, hedge mustard, and cinquefoil in flower. I never remember so many willow-warblers, tree-pipits, greater whitethroats, and nightingales locally as there are this season.

June 2nd.—Water-figwort bursting. Goosegrass and dog-rose (one solitary flower of latter) in bloom. Saw two moles above-ground, which disappeared immediately underneath. Many more swifts this year than formerly.

5*th.*—Black bryony in flower.

8*th to* 16*th in Scotland.*—Observed 49 species of birds in the neighbourhood of Beith, Ayrshire. My two friends (John Craig and Matthew Barr) have found up to date seventeen grasshopper warblers' nests, which is believed to be the record for Scotland. Woodpeckers and nuthatch unknown here. Eighty-three species of birds have been known by these two observers to nest in the parish; 33 species have been recorded beyond these, making a total of 116 species. There are about 300 species of ferns, wild-flowers, and trees which have been identified. Also 12 species of butterflies, 17 species of mammals, 9 species of fish, 3 species of amphibians and batrachians, and one reptile—a lizard. They also found this spring a corn-crake's nest containing no less than 19 eggs, instead of the usual clutch of 7 to 10.

16*th.*—When on the summit of Arthur's Seat, near Edinburgh, saw pied wagtail, carrion-crow, herring and black-headed gulls, and whinchat,—over 1000 feet above sea-level.

29*th.*—Many meadow-brown butterflies on wing, a pleasing observation after the marked absence of butterfly life in Scotland.

30*th.*—Moneywort, agrimony, yarrow, foxglove, St John's wort, and self-heal in flower. Heard nightingale sing for last time. Noted the alarm note of the swallow—something like that of the pied wagtail.

Note.—These observations refer to the district of St Albans, Herts, unless otherwise stated.

(*To be continued in our next.*)

Spring Fungi.

By Carleton Rea, B.C.L., M.A., &c.

Many people think that the autumn months are the only time when collectors of fungi have specimens to obtain. This is a common error, and I would urge all botanists who have not hitherto interested themselves in this important branch of their particular hobby to at once direct their attention to the same. Phanerogams, or flowering-plants, embrace a study of some 1958 British species, whilst the native fungi include at least 7000, and probably 8000 species would be nearer the mark. Further, the study of British fungi may be pursued year in year out, and so the assiduous worker in this branch has never a slack time, but has almost unlimited opportunities for adding to the British record, or elucidating the life-history of those species already recognised.

It is the purpose of the present article to draw the attention of field workers to a few striking examples which any careful observer may note in the spring of the year.

First to be noted are the *Morels*, which are esteemed a delicacy for the table wherever they are met with. They are of fairly common occurrence in our eastern counties, and generally distributed elsewhere; but in the former there is scarce a farm lady who does not know how to serve these delicious esculents, and appreciate them as much as we do the common mushroom (*Agaricus campestris*), the horse mushroom (*A. arvensis*), or its blood-juiced ally, *A. hemorrhoidarius*—I fear it has no English name in common use.

Morels are, however, quite distinct from Agarics, and here we must attend to an elementary point. Agarics—that is, mushrooms and others of their sort—have gills on the under surface of the cap; if these be placed on white or black paper overnight they will in the morning be found to have emitted a deposit of spores in the mass which is coloured either white, pink, rust purple, or so-called black. This is a great clue to the determination of the species of the Agaricini.

Morels, on the other hand, have their spores contained in sacks or bottle-like structures, and if these same be deposited on white or black paper no effect will be found, because the bottle is still uncorked. It is true that on the liberation of ascospores a slight puffing will be seen, but this is dependent on hygroscopic conditions, and will not be a guide to the collector of fungi, though an interesting phenomenon to observe.

Mycologists term the first class Basidiomycetes—*i.e*, those that bear their spores free, not in vesicles. The latter group is known as the Ascomycetes, and their spores are termed ascospores. Morels belong to the Ascomycetes, and are rather weird and strange forms to the botanist when first met with. They prefer, I think, naked soil, but are also to be met with in pastures and woods. Their shape is generally mitrate, and they bear the ascospores on the upper surface of the cap. In the genus *Morchella* and *Mitrophora* the cap is covered with deep angular pits, whilst the genus *Gyromitra* is characterised by the brain-like or intestine-like convolutions of the exterior of the cap. *Morchella* has the cap adnate to the stem, but in *Mitrophora* it is free in the lower half. These three genera include ten British species. *Morchella esculenta* has the stem short and the pits on the caps somewhat pentagonal, and is generally of a pale yellow or buff colour. *M. crassipes*, and its variety *Smithiana*, have the pits large and irregular in form and long stems.

The type has the cap brownish, whereas the variety is tawny in colour and has a tomentose stem. *M. elata* and *conica* are both characterised by longitudinal ribs, but the stem is furfuraceous in *elata*, and only minutely villose in *conica*, which is a smaller plant. *Mitrophora* has three species: *gigas*, which is distinguished by its large pruinose stem; *semilibera* by its smaller, nearly even, stem; and *rimosipes* by its longitudinally grooved or striate stem. *Gyromitra esculenta* is of a brown colour, whereas *G. gigas* is much paler and larger in size, and has the ascospores subfusiform as contrasted with the elliptic shape of those of *esculenta*.

In early spring the eye is often arrested by the pretty blood-red discs of *Geopyxis coccinea*. It grows on twigs and sticks, and the exterior of the cup and stem is clothed with a white tomentum. This is sometimes sold in the markets, and makes a very pretty decoration for the table when mixed with moss. It is erroneously called "king cups" in some localities, and I have met two or three persons who persisted in avowing that they were Jew's-ears.

The true Jew's-ear (*Hirneola auricula-Judæ*) is at its prime in the spring, and is generally to be found on any fair-sized elder-bushes. It is of a cartilagineo-gelatinous consistency, and the dark-brown spore-bearing surface is much wrinkled and folded, and in many cases resembles an ear, whilst the exterior is of a greyish-olive colour and minutely tomentose.

Next we shall probably meet with some of the larger *Pezizæ*, a group that bears its ascospores in cuplike or rather saucer-shaped receptacles. Amongst these may be mentioned *Peziza venosa* and *P. reticulata*, both of which are characterised by the presence of a strong nitrous odour; but in the former the ascospore-bearing surface—that is, the interior of the cup—is umber brown, whereas in the latter it is fulvo-rufescent.

In late spring (June) I have gathered *Sepultaria coronaria* in great quantities under beeches. It appears at first almost like a puff-ball, but it soon splits into a number of segments, and discloses the interior of the ball, which is at first pale and then becomes somewhat purplish. It is a delicious esculent, very delicate in flavour, and only requires ten minutes' cooking.

Plant parasites are also to the fore at this period of the year, and an early worker should look out for these. First cress seeds that damp off are generally attacked by *Pythium de Baryanum* or an allied species. This is an interesting find to the student of fungi, as it enables him to see for himself the sexual process, which has become obsolete or entirely wanting in the great majority of fungi.

Later on, when our attention is directed to the pretty blooms of the wind-flower (*Anemone nemorosa*), we note that its leaves are attacked by two parasites. The one consists of a small white cup which, viewed with a pocket-lens, is really a very pretty object. This was known in former years as *Æcidium leucospermum*, and some German authorities claimed that it was the æcidial condition of *Puccinea fusca*; but this theory has been disproved by the researches of the late Mr Soppitt, who undoubtedly proved that it was an *Endophyllum*, a result I had myself ascertained concurrently. The spores of an *Æcidium* on germination put out a germ-tube, which enters the host plant by its stomata; those of *Endophyllum* produce a promycelium and then abstrict promycelial spores. The other parasite to be found on the wind-flower consists of dark blackish-brown dust, which covers all the surface of the leaf and is known as *Puccinea fusca*. This, on microscopic examination, shows two superimposed spherical cells on a hyaline pedicel, and constitutes the character of the genus *Puccinea*. It was in former days regarded as the sori of a fern, so distorted are the leaves of the plant by this parasite, and it is thus referred to in Ray's 'Synopsis' (3rd edition, 1724): "This capillary was gathered by the Conjuror of Chalgrave," and was afterwards referred to as the Conjuror of Chalgrave's fern.

In the month of April, and sometimes later, we notice the wild junipers marked with an amber excrescence of a fusiform shape. This is known as *Gymnosporangium clavariæforme*. It is really only another form of *Puccinea*, the characters of which I briefly set out above; but in this case the spores (technically called teleutospores) are immersed in a gelatinous matrix. The æcidia of this species are not so cup-shaped as those of *Endophyllum leucospermum*, but are at first flask-shaped, and then cylindrical and torn down the length of the tube. They were formerly known as *Rœstelia lacerata*, and have been found from June to August on hawthorn and pear. But they would now be referred to as the æcidious condition of *Gymnosporangium clavariæforme*, since the alternating generations have been worked out. Thus the first portion of the life cycle produced by the germinating teleutospore produces the æcidiospores of the hawthorn and pear, and the æcidiospores in their turn produce the teleutospores on the juniper.

This large group of parasitic fungi must now be left, as we are sure that every field worker must know well the rust on the leaves and culms of our cereals; but it is interesting to note that although the microscope reveals no characters which will separate some of these rusts, still so fastidious have some of them become that they will flourish on only one particular host plant.

I will now conclude this peep at spring fungi with a reference to the St George's mushroom (*Tricholoma gambosum*), which, true to its English name, I have found on the 23rd of April; but it also flourishes throughout May and early June. It grows in rings on our pastures, and has the surface of the pileus whitish tan. The stem is solid and white, and the gills are whitish with a curve near their attachment to the stem; the spores are white, and the whole plant smells strongly of new meal. It is most excellent eating, but I cannot tell why the rustic population should term it a mushroom, as all the Agarics have purple spores which ultimately turn the gills a dark colour: the gills, too, are free from the stem, and the stem is encircled by a large ring.

Marsh Botany in Spring.

By William A. Dutt.

Spring comes slowly to the marshlands. While the roadsides and field-banks of the uplands are yellow with primroses, the gorse is in full glory of bloom on the heathlands, and the woodlands are carpeted with bluebells, the widespreading marshes are still for the most part dreary in aspect and tawny in hue. The marshmen reckon that spring begins on April 6, for by that day, they say, the "colts," or young reeds, are visible above water, and the cutting of the amber-stemmed, grey-plumed reeds must be suspended until next winter. But on the 6th of April you may often look in vain on the level lowlands for such evident floral signs of spring as can be seen in the fields, woods, and upland pastures. One of our commonest marsh flowers, the marsh marigold, often blooms very early in the year, and it is generally believed that by the end of March the marshes are yellow with its bright blossoms; but in eastern England, where the widest expanses of marshland are exposed to keen sea-winds in spring, we have to wait until the middle of April for its full blooming. Writing of this plant, I may say that I have found its sub-species or variety *Caltha Guerangerii* by no means uncommon in the Broadland district. In this variety the flowers are generally small, and the sepals — the marsh marigold has no corolla, but yellow petaloid sepals—rather wide apart.

During April the most conspicuous marsh flower is, of course, that lilac-blossomed crucifer, the lady's-smock or cuckoo-flower (*Cardamine pratensis*), concerning which Gerarde says, "It doth flower in April and Maie, when the cuckoo doth begin to sing her pleasant notes without stammering." Contemporary with it appears, by the riverside, *C. amara*, a rarer plant of more straggling habit, and bearing white flowers. Late in the month the marsh valerian (*Valeriana dioica*) may be seen springing up amid the cuckoo-flowers on many swampy marshes. It is not until the middle of May, however, that this plant becomes in any way conspicuous. It is remarkable for bearing four kinds of flowers—viz. (1) corolla large, pistil absent; (2) corolla small, pistil rudimentary; (3) corolla smaller, anthers rudimentary; (4) corolla very small, anthers absent. This marsh valerian, with the dandelions—*Taraxacum palustre*, the marsh dandelion, is distinguished from the other varieties by its narrow sinuate leaves—the daisies, and a few buttercups, make up the April bouquet of marsh flowers, to which a few twigs of ruddy bog-myrtle may be added to give a fragrance that would otherwise be lacking.

When May is come it is not too soon to look for the marsh orchids, two of which, at least, are sure to be found sending up their pink or purple spikes during this month. These are the marsh orchis (*O. latifolia*) and the green-winged orchis (*O. morio*). *O. incarnata*, a sub-species of *O. latifolia,* is said by Hooker to be found only in Wiltshire, Hampshire, and Cornwall, in England; and Cork in Ireland; but the varieties of the *O. latifolia* are often confused, and the records of their occurrence are not all absolutely reliable. *O. latifolia* proper, however, blooms a good month before its sub-species, and the latter always has unspotted leaves. Towards the end of May the green spikes of the twayblade (*Listera ovata*) lengthen so as to become easily noticeable; but the twayblade, owing to its lack of bright colour, is not a popular plant with those field botanists who go abroad trowel in hand in search of orchids. *O. mascula*, the early purple orchis, occurs on many marshes, but is more a plant of the copses and upland pastures than of the peaty lowlands.

In June other orchids bloom, the most noticeable among them being the spotted orchis (*O. maculata*). This is the plant to which the old herbalists gave the name of dead man's fingers, owing to the finger-like lobes into which its tubers are divided. It is a very variable species both in regard to its form and the colour of its flowers. It is one of the commonest of our British orchids, growing in every English county, and having a range in Great Britain from Shetland to the Channel Islands. Of rather more local distribution is the butterfly orchis (*Habenaria bifolia*), a plant more familiar to many field botanists in its woodland form, *H. chlorantha*. This may be found in bloom in June; as also may the beautiful marsh helleborine (*Epipactis palustris*), an orchid to be sought in those boggy places where dainty bog pimpernels trail over the sphagnum, white tufts of cotton-grass warn us to be careful where we set our feet, and patches of marsh red rattle, as ruddy as bog-myrtle, stain the quaking surface of the swamps.

No branch of botanical study is more interesting than that of flower fertilization, and no work on this subject is more fascinating than Darwin's 'On the various Contrivances by which British and Foreign Orchids are fertilized by Insects.' From this work we learn that orchids possessing long spurs or nectaries are fertilized by lepidoptera, those with short nectaries by bees, wasps, and flies. This subject is too wide to be treated of in these notes; but for the instruction and amusement of young botanists I will quote a passage from Mr E. Step's 'Wayside and Woodland Blossoms,' in which the author briefly indicates how the processes of fertilization may be made clear by a simple experiment. He tells his readers to take a finely-pointed pencil to represent the head and tongue of a bee in search of nectar. "We push the point gently down the spur [of the orchid], when a part of the pencil touches against the rostellum and presses it down, touches lightly the viscid feet of the pollen masses (*pollinia*), and as the pencil is withdrawn both come with it, and stick out from it like a pair of horns. Be careful to hold the pencil in the exact position it now occupies, and watch. The heavy heads of the pollinia are drooping forward, but after a few minutes they cease to fall lower. Now push the pencil into this other flower. The pollen masses go directly to the stigma, and some of the pollen is detached. If you are watching where orchids grow it is no uncommon thing to see insects flying round with these pollinia attached to their heads or tongues like a pair of horns. It will be seen to be impossible for the pollen to fall upon the stigma of the same flower, and from its elastic attachments it is impossible that it should be carried by the wind to another flower, so that insect agency is here an absolute necessity." This experiment may be tried with *O. mascula*, *morio*, *maculata*, or *latifolia*.

The bogbean or buckbean (*Menyanthes trifoliata*), one of the loveliest of our marsh flowers,—indeed, of our British wild-flowers,—begins to bloom in May. The more boggy the marsh the more likely it is to contain this exquisite flower—in fact, I have seen it growing in a dyke, where its trifoliate leaves were entirely submerged and its beautiful spike of pink-and-white flowers rose from the water like the whorled spike of the water-violet. The day when I first saw it—on a rush marsh not far from the banks of Oulton Broad—was a red-letter day of my botanical life. It bears a superficial resemblance to an orchid, and at first glance might be taken for one; but it really belongs to the Gentian family, and has a campanulate corolla, fringed inside with delicate white filaments. In similar situations to those favourable to the bogbean two ferns, the fragile marsh fern (*Lastræa Thelypteris*) and the curious adder's tongue (*Ophioglossum vulgatum*), appear in spring, the dusky purple-flowered marsh cinquefoil (*Potentilla palustris*) and the marsh stitchwort (*Stellaria palustris*) are not uncommon, and the rarer marsh pea (*Lathyrus palustris*) may be found locally south of York and Carnarvon.

In the dykes, where after the end of March the newts and amorous frogs are active, the water-violet (*Hottonia palustris*), the water-plantain (*Alisma plantago*), the lesser water-plantain (*A. ranunculoides*), and two or three species of water-crowfoot (*Ranunculi*) can be found in bloom in May; while along the sedgy margins the forget-me-not opens its sky-blue eyes amid the trailing stems of the brooklime (*Veronica Beccabunga*), and the tiny white bog starwort (*Stellaria uliginosa*), the chickweed of the water-side, fills up the hoof-prints made by the cattle when they come to the dykes to drink. Not until June, however, does that other aquatic speedwell, *Veronica Anagallis*, flower; and the leafy month is usually "well in," as they say in Norfolk, before the three-petalled blossoms of the frogbit (*Hydrocharis morsus-ranæ*) deck the surface of the weedy dykes. By that time the yellow and white water-lilies—for white water-lilies there is no place in England that I know of like a certain "grown-up" broad in East Norfolk—have raised their heads above water. The beautiful flowering-rush (*Butomus umbellatus*) is also now in bloom, and that strange insectivorous plant the bladderwort (*Utricularia*) is sending up its spikes of yellow snapdragon-like flowers from the stagnant or slow-flowing waters.

The bladderworts are among the most interesting plants to be found in our marsh dykes. They are rootless, and, like the water-soldiers of which I wrote in the first number of this Magazine, rise to the surface of the water in summer, sinking to the bottom at the approach of winter. When they rise to the surface they are buoyed up by a number of little bladders or vesicles interspersed, in most species, among the hair-like segments of the submerged leaves. These bladders are the plant's insect-traps, for each has an orifice fringed with stiff bristles and furnished with a valve-like door or shutter which opens to the slightest pressure from without. "Abandon hope all ye who enter here" might well be inscribed over these dread portals, for no aquatic insect that enters ever emerges, but is, like those which settle on the viscid leaves of the sundews, absorbed by certain specially constructed cells, with which, in the case of the bladderworts, the interior of each bladder is lined. These cells, writes Professor von Marilaun, are "linear-oblong, and somewhat like little rods in shape, and they line the whole internal surface of the cavity of the bladder. They are arranged in fours, each group of four forming a cross, and being united by a common basal cell. The basal cells themselves are intercalated amongst the cells lining the bladder. The organic substances from the decaying bodies of captured animals are sucked up by these stellate groups of cells, and from them pass into the basal cells, and later into the other adjacent cells of the bladder and those of the plant at large." Rotifera and infusoria constitute the principal food of these carnivorous plants; but the larvæ of gnats are also captured and consumed. *U. minor* seems to be the most insatiable of our native species, and some remarkable lists of the contents of its bladders have been compiled. The bladderworts are distributed over nearly the whole world. Most of them are water plants,—one exists solely in the rain-filled receptacles of *Tillandsia* plants,—but a few grow among mosses and lycopods, in rock crevices, and the bark-fissures of old trees. Of the three British species—*U. vulgaris, minor,* and *intermedia*—*U. minor* is the commonest, and *U. vulgaris* has the widest distribution.

I have left myself no space in which to deal with the sedges, nearly all of which flower in spring and early summer.

The *Cyperaceæ* is not a popular family with beginners at Botany, who will hardly admit that its flowers have a right to the name; but to the micro-botanist this family offers a fascinating study, to which we may refer on some future occasion.

Some Birds in Shakspear.

By J. L. Bevir, M.A.

The Raptores.

At an entrance examination at one of our public schools a candidate replied, in answer to the question, Who was Shakspear? "He was a poacher." This, though not a very exhaustive account of the immortal bard, and possibly not a true one, speaks of the fact that the poet was brought up in the country, and took an interest in natural history. His intimate knowledge of nature is largely borne out by a careful perusal of his works, which are full of references to birds and beasts, and I thought it might not be uninteresting to collect what he says about the Raptores and Corvidæ, adding a few notes relative to the birds in his day and our own.

Before speaking actually of the birds, I should like to remind my readers of a peculiarity of Shakspear which runs through all his works, and that is his fondness for assonance, and for playing upon words. No situation is too serious for him to pun, for Lady Macbeth says to her trembling and unnerved husband after he has murdered Duncan, as she takes the dagger from his hands—

> "I'll gild the faces of the knaves withal,
> That it may seem their guilt";

and no *jeu de mot* comes amiss to him, however far-fetched. At times he will go on making a series of puns on the same word. I recall this, for this playing upon words may help one to explain several of the quotations in which he alludes to birds.

Having said this much, I will turn to the Raptores, and naturally the biggest birds claim attention first. Even in

Shakspear's days Eagles and Vultures were not very common, and consequently he dealt with them in much the same way that Dante does when speaking of animals of which he had but little personal knowledge; that is to say, he confines himself to generalities, or takes refuge in classical allusions. This is particularly true of Vultures. There are two of this breed that appear as British birds—the Griffon Vulture (*Gyps fulvus*) and the Egyptian Vulture (*Neophron perenopterus*). The latter, though filthy in its habits, is a magnificent bird, quite ladylike in its appearance about its neck, with its cloud of down. I have never met with them in England, but I have seen them wheeling round and round the rugged crags of the Picos de Europa in Northern Spain. I have even watched one close, disposing of some carrion near a farmhouse, where I nearly stalked it on the ground. I doubt Shakspear ever having seen them, for all his references seem to picture the bird as it was known to the Ettrick Shepherd in 'Noctes Ambrosianæ': "He has a hideous head of his own—fiendlike eyes and nostrils that woo the murky air—and beak fit to dig into brain or heart. Don't forget Prometheus' liver"; and Shakspear does not do so. He says, "Let vultures gripe thy guts"; "Let vultures vile seize on his lungs"; or again, "The gnawing vulture of the mind." There is no touch of the naturalist here, and this is true in part of what he says of Eagles. To him the bird represents what is princely, and in "Cymbeline," where it is most often mentioned, it has the further connotation of belonging to Rome. Otherwise he deals with its proverbial keen-sightedness ("Love's Labour's Lost," iv. 3), "Peremptory eagle-sighted," as also in the same scene, "The lover's eyes will gaze the eagle blind." Beyond that he speaks of its voraciousness, especially when hungry (in "Henry VI.," i. 1)—

"The Duke,
Whose haughty spirit, wingèd with desire,
Will cost my crown, and like an empty eagle
Tire on the flesh of me and of my son!"

But hungry eagles tire as little as the vulture, of which Michelet says: "Ils mangent un hippotame et ils restent affamés. . . . Rien ne fait lâcher le vautour; sur le corps d'un hippotame Levaillant en tua un qui, blessé à mort, arrachait encore des morceaux. Était-il a jeun? point de tout: on lui en trouva six livres qu'il avait dans l'estomac."

There are quotations, however, which seem to come from personal observations. For instance ("King John," v. 1)—

> "No! Know the gallant monarch is in arms,
> And like an eagle o'er his aiery towers
> To souse annoyance that comes near his nest."

He is speaking of the Golden Eagle evidently, as Christopher North knew him, and as I have watched him in Norway, hover over his nest and then speed across the fjord, sometimes stooping quite low in search of chickens or the like, sometimes winging straight for the opposite mountain heights, where he will hunt the rÿpe or the blue hare.

Shakspear apparently knew something of their nests, perhaps he may have tried to take the young eyeases, as he mentions them in "Hamlet," ii. 2,—at anyrate he has observed their thievish propensities with regard to nests ("Richard III.," i. 3)—

> "Your aiery buildeth in our aiery's nest,"

where he is using aiery as Virgil does *nidi*, to mean the inhabitants of the nest and not the nest itself.

But the passage which seems to me to be closest drawn from Nature is in "Henry IV.," where Shakspear is speaking of Madcap Harry's retinue who have gone to war. I think he must have seen an eagle in captivity; if not, he has been extraordinarily lucky in his observation of the bird in its wild state. He says ("Henry IV.," Part II. iv. 1)—

> "All furnished, all with arms;
> All plumed like estridges, that with the wind
> Bated like eagles that have lately bathed."

I am writing from a natural history point of view, and do not care to discuss minutely textual criticisms; but I may say there are several versions of these lines, some reading "with the wings bated," which does not affect the general sense. In either case the picture is a true one.

The Prince of Wales (to whom the ostrich feathers were emblematic) and his retinue come on with nodding plumes,

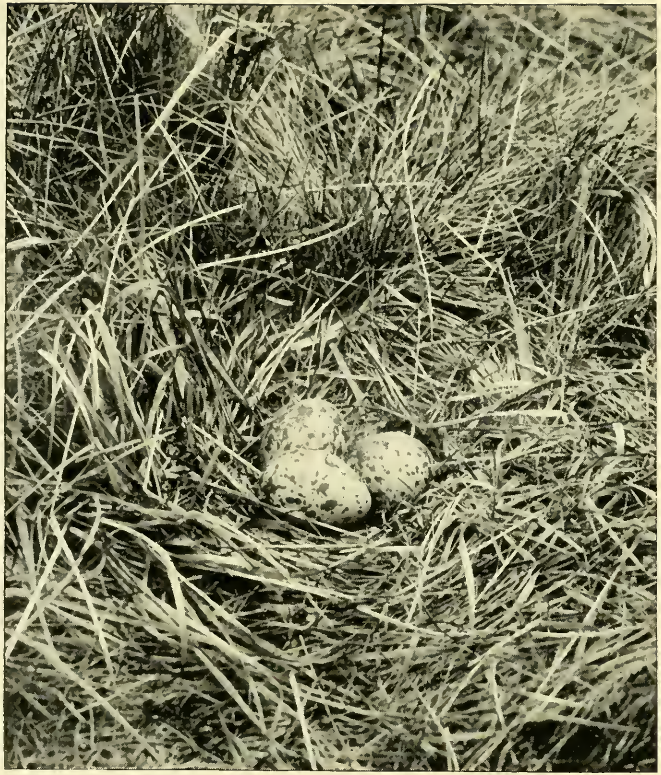


Photo by T. Dewhurst, Preston.

NEST AND EGGS OF LAPWING.

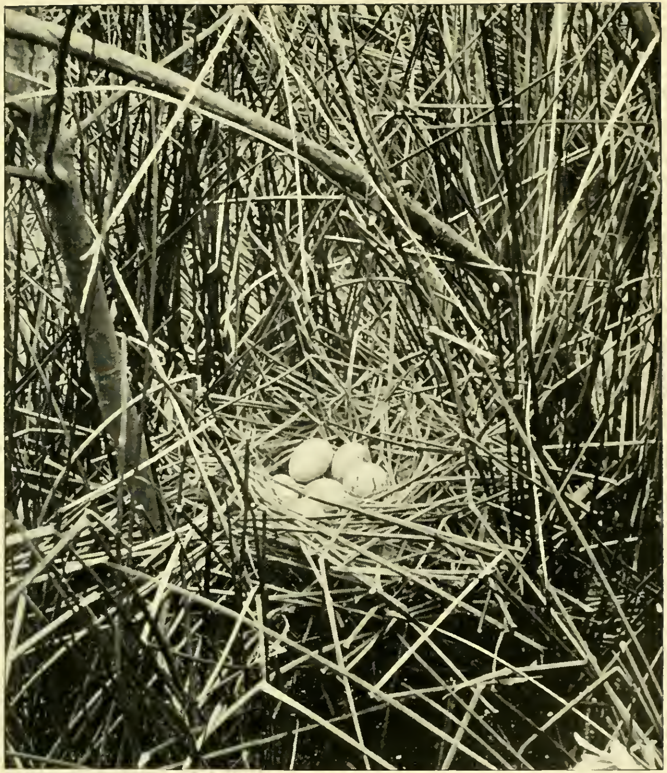


Photo by T. Dewhurst, Preston.

NEST AND EGGS OF MOOR-HEN.

which as the wind catches them curve and hang back like a bird "bating." What does that mean? To "bate" was a term in falconry, when the hawk, instead of soaring into the air as it should, fluttered to the ground, and ran along the ground with wings half-spread, moving them irritably backwards and forwards, as he mentions in the "Taming of the Shrew," where he speaks of kites

> "That bate and beat and will not be obedient,"—

an excellent word to apply to an eagle that has lately bathed, as far as my experience goes.

I was coming out of the little aquarium at Bergen, and found myself opposite a well-arranged aviary containing two golden eagles. It was latish in the day: monsieur had had his bath, and dried himself fairly, and was sitting on the branch of a withered tree, still looking rather a draggled fowl; madame was standing on the edge of a shallow tin full of water, the kind of receptacle into which Brer Fox put the stork's food when he entertained her. She was a little annoyed at finding a stranger come to look on at Diana in her bath; in fact she said so emphatically. But I did not move, and ultimately she determined that I was beneath contempt and proceeded with her ablutions. To a human being the performance was very quaint, but I restrained myself. When however the bath was finished, and she began to run up and down with bated wings, though I pictured to my mind all that happened to Kalif Stork in Hauff's inimitable tale, I broke out into loud laughter. Nothing happened to me, but her majesty was grossly offended, and wet as she was, she went and joined her royal spouse on the withered tree.

Beyond one allusion to the Osprey, that is all that there is to be said on Eagles, and the mention of the Kite naturally brings one to the Accipitres, which at that time were chiefly known to Shakspear from the point of view of falconry. But this is not true of the Kite, for in Henry VIII.'s reign it was a very common bird, even in London, where it performed the duties now discharged by the District Council, as an unpaid scavenger. As such it was a *sacro sanct*, and by its beneficent agency, once more to borrow from Michelet, "En un moment, une effrayante masse de fermentation putride dont on n'osait plus approcher a disparu, est rentrée au courant pur et salubre de la vie universelle."

I doubt if there are any of the hawk tribe to be found in the City now, amidst its turmoil and its sky-sign advertisements, though in 1848 Stanley mentions them as fairly frequent; but I was very pleased last year to watch five hawks sailing round the tower of Cologne Cathedral and settling on its pinnacles, in apparent harmony with the jackdaws that build there.

The kites of those days seem to have been very well behaved, at times taking food from the hands of children. At the same time your kite when bent on building a nest was an arrant thief, and would steal anything from a leather strap to a frill, as Gould says, "When the species was plentiful it must have kept the housewife on the alert for her frills and her furbelows," where, if I remember right, he is alluding to a remark of Autolycus ("Winter's Tale," ii. 3)—

> "My traffick is in sheets,
> When the kite builds look to lesser linen."

The only actual instance I know of stealing lighter washing is one of a Blackbird, but Jackdaws and Magpies collect much varied matter at times.

The Kite being a biggish bird, and withal a bit mischievous, has been much persecuted, so that from being one of our commonest birds, Seebohm now speaks of him as "an accidental visitor." I know a gamekeeper in Cambridge who took a kite's nest some twenty years ago, and declares that it is the last instance of kites breeding in England. I doubt it, but I have inquired very widely from Cornwall to Cornhill-on-Tweed, and wherever I have heard of the kite breeding, the date has been somewhat remote.

To return to Kites in Shakspear, there is a cruel look in its eye, a general sense of merciless beauty, and so he uses it often in a bad sense—"Macbeth," iv. 3, "O Hell-kite"; "Henry V.," ii. 1, "Fetch me the lazar-kite"—for he noticed that, like the crow, it will not attack big living animals, but waits until they are carrion ("Julius Cæsar," v. 1)—

> "And kites and crows
> Fly o'er our head, and downward look on us
> As we were sickly prey."

When the poet wants to be more contemptuous, he calls the Kite a Puttock, a word which most think is a contraction for Poult hawk, though some consider it a corruption of Buteo, so much so indeed that Bewicke gives Puttock as the second name of the Buzzard.

I must pause for a moment to deal with a misconception which confuses Puttock with the Shakspearian Paddock, the Old English for toad. The confusion comes from Scotland, for north of the Tweed they call a toad a Puddock, and often pronounce it Puttock. This is a mistake; a toad is Paddock, as the Norwegian Padde confirms.

I return to this degenerate form of kite. The most striking quotation is "Henry VI," Part II. iii. 2. Beaufort and Suffolk are expressing their regret at Gloucester's death, in which those round them believe them implicated. Warwick says—

"Who finds the partridge in the puttock's nest
But may imagine how the bird was dead
Although the kite soar with unblooded beak."

The other allusion which the poet makes to the Kite in its wild state refers to the domestic economy of all the hawk tribe, in the way in which they emit the indigestible refuse of what they devour ("Macbeth," iii. 4). Macbeth has had Banquo murdered, and the ghost appears and sits in Macbeth's seat. At the sight of it Macbeth raves and thus addresses the apparition—

"If thou canst nod, speak too.
If charnel-houses and our graves must send
Those that we bury back, our monuments
Shall be the maws of kites."

Tennyson alludes to it in "Aylmer's Field," where he wishes to draw the mind of his reader to how all the haughty schemes of purse-proud vanity have failed, and nature has reasserted its sway—

"Where the two contrived their daughter's good.
Lies the hawk's cast, the mole has made its run."

This finishes the allusions to Hawks as *feræ naturæ*, and one passes naturally to such birds used in falconry, for the kite was not only used for hawking but at times acted as quarry.

(*To be continued.*)

Animal Photography.

By Alfred Watkins.

Within the last ten years a very striking change has taken place in the illustration of natural history subjects. Photography has been available for many years; but the naturalist had rather overlooked it, and if he wanted photographs, had to call in the professional to his aid, with most unsatisfactory results. It is the same now as in the days of Bewick—no one but the naturalist himself can illustrate his own writings so as to be in complete touch with the subject.

A new school of naturalists therefore—quite free from the old contempt for the "mechanical photograph"—have made themselves masters of the handicraft, and being naturalists first and craftsmen afterwards, have raised photographic illustration in these matters to a higher level. The names of Saville Kent, the brothers Kearton, Lodge, Pike, and English, will illustrate this point. Who can now lecture on a subject requiring illustration without photographic slides? And how much more effective such illustrations are if they are obviously the lecturer's own work. I write, therefore, with the idea and hope of helping those naturalists who wish to avail themselves of the modern means of illustration so ready to hand.

At the very outset there is a pitfall ready for the unwary. Innumerable are the varieties of tempting hand-cameras of every type. I have nothing to say against these for the summer tourist, or for the reader who does not wish to go beyond an occasional snap-shot of sheep, horses, cattle, and so on; but to the average member of a Naturalist's Field Club—the readers I am writing for—the following considerations must be noted.

It will often be required to photograph an object full size, and to do this the camera *must* rack out to double the usual focus of the lens. In the great majority of cases the camera must be fixed on a stand, not held in the hand. I think it will be found that almost all the good work of such naturalist photographers as are named above has been done with a stand-camera. Now it will be argued that hand-cameras can be purchased to focus, and that they also can be fixed on a stand. Yes, but can they be found to rack out to double the focus of the lens? The usual focussing movement is much slighter than this. There is one type of hand-camera which comes much nearer the naturalist's requirements, and may be worth consideration for those with a deep purse. This is the reflecting type, in which the full-sized image is focussed up to the time of exposure, and is therefore suitable for outdoor work in a good light. A "twin-lens" camera has a similar advantage, but is terribly bulky. In both these cases, however, the degree of racking out should be investigated.

On the whole, I should advise the purchase of a modern bellows-body stand-camera with long extension, three double slides, a light wooden twofold sliding-leg tripod (not threefold), and a shutter with a pneumatic release. The shutter may be the "unicum" type, or the time and instantaneous-blind pattern. A camera of this description can always be used as a hand-camera if a finder be fastened to it, and as a matter of fact those hand-cameras which rack out sufficiently are not more convenient for hand work than this will be.

The size is the next point for consideration. Where lantern-slides are the main object the small "quarter-plate" size will be the most suitable, and the weight is much less for carrying about. But for book illustration and album work this size is rather small, and the popular half-plate size is advisable. The blind-shutter had better be fixed behind the lens so as to be part of the camera, instead of in its more common position on the hood. An extra long length of tubing is sometimes convenient, so that the camera may be placed in position and focussed upon a point where a bird or animal is expected to alight, while the photographer lies in a near and convenient hiding-place ready to press the air-ball connected with the shutter. In such a case the camera is masked with a green cloth or a heap of straw or twigs.

The selection of a lens is important. As a rule, it should be of longer focus than that usually assigned for the size of plate, and I am inclined to think that a good "single" landscape lens will serve every purpose, extreme speed excepted (as for flying birds). A landscape lens at full opening requires about double the exposure of an R.R. (doublet) lens, and this in its turn requires about double the exposure of the modern anastigmat, full opening being presumed in each case. But although most animal photography should be done with fair rapidity, the occasion for what is called an instantaneous exposure is much less frequent than might be supposed. Probably exposures of from $\frac{1}{8}$ to $\frac{1}{2}$ of a second will be most general, and the popular idea that everything is done by a "snap-shot" (about $\frac{1}{30}$ to $\frac{1}{60}$ of a second) is very wide of the mark.

Rapid plates of a good make should be used, not the slow or ordinary brands. But, on the other hand, it is not well to select plates of extreme rapidity, as these are liable to "go off" with keeping, and do not always give such good results as the same maker's second brand of plate. I certainly advise that plates, and not celluloid or rollable films, should be used.

Those who have read the brothers Kearton's fascinating work 'With Nature and a Camera,' will form a good idea of the many ingenious shifts the enthusiastic naturalist devises for his photographic work, and will be struck with the many different ways in which a tripod is fixed. Whether when waist deep in a stream for the nest of a water-bird, suspended by rope from the edge of a lofty cliff after peregrine falcons, high up in the branches of a lofty tree taking the nest of a carrion crow, or in other like predicaments, the tripod is always part of the outfit. Probably the reason is that the use of the tripod leaves more freedom for the use of the hands and limbs than the hand-camera, which monopolises the use of both hands. In many cases, as in taking a bird's nest high up in a hedge, the tripod legs are lengthened by sticks lashed to them. In such work the first essential is, of course, an enthusiastic love of the subject, and the rest is summed up in the one word—patience. For all wild animals the capacity of keeping perfectly still and waiting for long periods is absolutely indispensable.

The stalking down of freely moving wild creatures, whether birds, mammals, reptiles, or insects, is the most difficult and fascinating branch of the work, but by no means the only useful one. The photography of captive animals, of slow-moving ones, of anemones in a rock pond on the sea-shore, of fishes in aquaria (special narrow aquaria with parallel glass sides), are equally useful special branches. Even the photography of dead or set-up creatures is, especially in the case of insects, extremely useful for illustration. Douglas English advocates the rearing of the insect "sitters," and photographing in specially selected surroundings in every stage, and his book, 'Photography for Naturalists,' will be found invaluable.

It is impossible within the prescribed limits to enter fully into working details of these different branches, but a few hints may be of service.

An infallible way of fixing the attitude of a dog is to take a biscuit out of the pocket and nibble it. The attention of a horse can be secured by getting an assistant to lead out into sight a stable companion. A toad or frog is not easy to secure: place either on a spot previously focussed, cover with a small box, allow a short time to settle in position, then raise the box and expose. An American writer, Dr Shufeldt, who gives the last hint, tells us that the best way of photographing a small living snake is by "coiling it all up in a bunch on the spot where it is to be taken, and then covering with the left hand. If held for a few minutes thus firmly, although very gently, covered, and then the hand slowly removed, an exposure can be made at the proper instant."

For many purposes, including photography of the inhabitants of the sea or fresh-water ponds, it is necessary to fasten the camera vertically, so that the lens points downwards. To do this a special angle bracket to screw on the tripod stand is required. This is made of a couple of boards about 7 or 8 inches square and $\frac{3}{8}$ of an inch thick, joined at one edge at right angles and strengthened by a strut. A socket corresponding to the camera screw is provided on one side, and a hole a shade larger on the other. The bracket is screwed to the tripod head with an extra camera screw, and the camera is then fastened to its vertical side, the lens pointing to the ground. Many inanimate objects closely connected with animal photography are conveniently photographed by laying on the ground, and photographing with the camera vertical as described.

Insects and small objects can be taken without shadow, and with a background of any desired tone as follows: Place the objects on a sheet of glass which is supported on two bricks placed edgeways on the ground. A piece of paper of any desired tint is laid on the ground as a background, and is too far away to show any shadow of the object. The camera is used vertically as before. If it is desired to use this shadowless plan with a horizontal camera, the insects or objects can be fastened to the glass (which is also vertical) by a useful cement made of equal parts of Canada balsam and bees-wax. The advantage of this plan is that after the objects are fixed the tone of the background can be changed to get the most suitable contrast.

It is but a small step from photographing small animals or objects to the subject of photo-micrography. Photographing with about the same degree of magnification—say about 3 to 5 diameters—as that afforded by a low-power pocket-lens, is easily attained with very little apparatus beyond the long-extension camera already advised. If the photographer, for instance, can obtain a 3-inch focus lens—either a photographic or a microscopic one—and screws it temporarily into the front of the camera, he can, with a 15-inch extension, take a photograph with a magnification of four times the original. An ordinary 1-inch micro-objective can also be used in this way, but the object to be taken must be of almost microscopic dimensions. For this class of work a long board the width of the camera should be provided, with strips of wood on each side, and a sliding upright stage in which a sheet of glass for the objects can be fastened. A bull's-eye condenser is useful for increasing the illumination of small objects. I found an arrangement of this kind most useful when making a set of lantern-slides to illustrate the life-history of the honey-bee.

As regards exposure and development, one of the text-books should be read up, as a sound idea of first principles will save much disappointment. The chief variant affecting the time of exposure is the activity of the light, and it is now generally agreed that an actinometer — usually sold with calculating scales, and called an exposure-meter—is a great help. We may have something to say on development on another occasion.

It is a decided advantage if subjects can be photographed on a known or uniform scale, and to do this it is convenient to mark the focussing-rack of the camera as follows: Cut a strip of cardboard four inches long and fix it horizontally on a wall. Draw a pencil line four inches long on the focussing-screen of the camera, and divide it accurately into inches. Move the camera backwards and forwards, and focus sharply until the 4-inch cardboard and 4-inch line coincide. Make a mark on the base-board of the camera to note for future reference how far this extends, and mark it 1 (for full size). Do the same to get the 4-inch object to coincide with 3 inches, and mark the extension $\frac{3}{4}$. In the same way the extensions for $\frac{1}{2}$ and $\frac{1}{4}$ can be marked on the camera. When in future it is desired to take an object, say, half the size of the original, the camera (the same lens of course being used) is racked out to the mark $\frac{1}{2}$ and moved bodily backwards and forwards until the image is sharp on the screen.

In our next issue we shall deal with some other aspects of out-door photography.

Norman Architecture.—I.

By Rev. P. J. Oliver Minos, Ph.D., M.R.A.S. (Lond.)

In this number I propose to indicate some of the more general characteristics of Norman architecture, such as come under the notice of field clubs on many of their field-day rambles, and in future papers we shall turn our attention to some more special points in the Norman style.

It is quite certain that A.D. 1066, the date of the Norman Conquest, did not witness the first introduction of Norman architecture into England: the Normans had sent over their architecture before the Conquest. The Norman style was first introduced into England in the time of Edward the Confessor (1042-1066), who founded the noble Abbey of Westminster in the year 1060. But although this Norman style had appeared in England, still it had not spread over the whole land even some years after the Conquest. There is no reason to doubt that some churches were built in the earlier style during the reign of William I. (1066-1087). For example, the churches of St Peter-at-Gowts and St Mary-le-Wigford, both in the city of Lincoln, may be mentioned. These churches, notwithstanding the evidences of what are correctly regarded as pre-Norman style, were built about the year 1080—*i.e.*, fourteen years after the Conquest, and at least twenty years after the earliest appearance of the Norman style in England. Such works as these are by no means to be regarded as the last efforts of a dying style, but rather as the lingering traces of one that had been general and vigorous.

The earliest attempts in England of the Norman style of ornaments were rude and irregular in their workmanship: no two of the points of the flat shallow zigzag (chevron) ornament were exactly of the same angle or of the same projection. Each ornament was roughly worked out of its own separate stone, and took its chance of being exactly in all respects like the others. In the earliest Norman work we have a singular lack of ornament, and much even of the work of the middle Norman period is very plain. The nave and choir of Peterborough Cathedral, which, except towards the west end of the nave, are of unaltered Norman character, show little attempt at ornament; yet Peterborough choir was consecrated in the year 1143, and probably a considerable part was built at even a later Norman date. The early Norman masons, whether master or apprentice, when engaged on ornamentation, seemed not to wait to measure out with exactness angles or projections by compasses, and did not work to labour to smoothness with the few tools then in use. The irregularity gave the impression of free hand—*i.e.*, power; and the rudeness or roughness of appearance suited the barbaric, *i.e.*, not classic, design. Hence the modern imitators of Norman style are generally stiff to exactness, and usually feeble in conveying any impression of power and grandeur. Take, for example, the doorway of Adel church, Leeds. To begin with, the stones are of unequal breadth, and so are the ornamental points carved upon them. One cannot help noticing how rude and irregular is the execution, and yet how grand and striking as a whole is the doorway! Here the Norman workman did not trouble himself as to mathematical exactness of angles or projections, but simply did his work as stone by stone came to hand. When finished he regarded his work as a whole, and went away satisfied that from this point of view it was imposing. Grace and beauty, fancy and delicacy, may safely be reserved for the later Norman period, such as may be seen in the Norman ornaments at Durham Cathedral.

In combination with irregularity and rudeness of workmanship, the Normans used enormously massive walls for their buildings. Perhaps this massiveness was to compensate for shallowness of foundation, in the hope that the effect of such great weight would be a firm settlement at the base. If this were so, the downward weight would and did make firm settlement at the base; but a collateral effect was that the walls were caused to crack and gape, and in some cases to collapse entirely.[1] However, one cannot but admire the Norman mason's skill in utilising the massiveness of walls at the doorways and at the chancel arches in receding concentric rings of arch decorations. The effect of this is magnificent, inasmuch as the builders who came after, if they retained nothing else of the Norman work, generally retained the doorways, and that, too, in many cases even when they had to remove the whole wall to a new position, as when aisles were added to churches previously without them. In such cases the builders very often numbered the stones, and rebuilt the Norman doorway stone by stone. The simplest and best way of realising the exceeding beauty and magnificence of such Norman doorways or chancel arches is by advancing and retiring, with eyes fixed on the repeated rings of mouldings. This procedure will show up the work in different light and shade, and thereby disclose the full force and beauty of concentric rings.

---

[1] The tower of Winchester Cathedral fell early in the twelfth century. William of Malmesbury tells us that "a few countrymen conveyed the body of the king, placed on the cart, to the Cathedral of Winchester, the blood dripping from it all the way; here it was committed to the ground within the tower, attended by many of the nobility, but lamented by few; the next year the tower fell, though I forbear to mention the many different opinions on this subject, lest I should seem to assent too readily to unsupported trifles, more especially that the building may have fallen through imperfect construction." The tower of Worcester Cathedral fell in 1175, the tower of Ely Cathedral in 1322, that of Chichester in 1861. The tower of Hereford Cathedral showed signs of weakness in 1841, and the lower part was then practically rebuilt.

The windows as well as the doorways show the same readiness of the Norman mason to utilise the massive walls. Glass, or perhaps one should say stained glass, had not yet come into general use; therefore very small openings or slits high up in the walls were made to admit light. But in order to secure the fullest advantage on the inside from these slits as seen from the outside, the Norman builders gave a very wide splay to the interior, so that within the building the windows appear much larger and wider, and thereby admit the greatest possible amount of light to the inside. Along the side walls, north and south, these narrow openings or slits were arranged at equal distances or intervals; but at the ends, east and west, of the building, they were generally three in number—the middle one rising higher than those on either side—grouped together. The later windows of the Norman style became longer and wider on the outside, with the splays on the inside remaining as wide, if not becoming wider. The walling between the splays became in some instances a mere edge, thus giving the appearance of a single or continued window with two or three or more lights; the edges also suggesting the idea of shafts in the later style.

As to the apsidal chancel, and the vaulted ceilings of the Norman period, I have little to say. I do not take apsidal chancels as characteristic of Norman style: what are termed apsidal chancels were built after the model of the Roman basilicas[1] or halls; and this form of the east end of a church continued in use throughout Roman, Anglo-Saxon, Norman, and Early English styles. As to vaulted ceilings, I think the Norman builder intended them for cathedrals and abbeys, and not for parish churches. I am aware of instances to the contrary, but these I regard as exceptions and not the rule. In parish churches the vaulted nave was rare, but the vaulted chancel was not unusual. The vaulting of this period, both early and late, shows considerable change. In the early style, frequently the ribs of the arches are entirely omitted; at a later period the vaulting was supported by ribs, and towards the end of the period these were frequently enriched by grand bosses.

---

[1] Basilica churches consisted generally of a nave and two aisles. Round the apse against the wall were stone seats for the clergy. The altar was in front of these, standing by itself, away from the wall. S. Nicholas', Wilton, has this apsidal arrangement of seats.

Developments in the early (or true) Norman style went on under the Norman kings; in fact, before the close of the reign of William the Conqueror's youngest son the Norman style attained its greatest grandeur in Durham Cathedral. But with the reign of Henry II. (1154-1189) the Transition or later Norman style fairly set in. At first the change was by almost imperceptible degrees; the general character and aspect of the work remained still decidedly Norman, as is seen on the front and western transept of Ely Cathedral. Briefly, some of the changes were as follows: the walls became less massive; the ornaments became richer and more complex; shafts and mouldings were multiplied; and the abacus became round instead of square.

Lastly, the pressure of arch (and vault) on walls reduced in massiveness revealed the lateral thrust. To combat this the later Norman style introduced the buttress or external lean-towards. These buttresses were at first stumpy, very massive, and very ugly; but later on the unsightliness was remedied, and buttresses became higher, slender, and graduated. Notice that the early buttresses were after-thoughts; therefore one seldom finds bond or tie stones in old buttresses—*i.e.*, they were built to lean against the lateral thrust, and to save the walls from being pushed out of the perpendicular. Had it not been for the buttress many of the Norman parish churches would have fallen down ere this, and would have left us no monument of Norman work to speak to our generation.

The Field Naturalist's Library.

REVIEWS OF BOOKS, TRANSACTIONS, ETC.

AMPHIBIA AND REPTILES. Hans Gadow, M.A., Ph.D., F.R.S. Pp. 668, medium 8vo. Being vol. viii. of the Cambridge Natural History Series. London: Macmillan & Co. Price 17s. net.

"Those who care for the study of Amphibia and Reptiles—the Herpetologists, to give them their scientific title—have never been numerous; but most of them have been serious students. One reason for the fact that this branch of Natural History is not very popular is a prejudice against creatures some of which are clammy and cold to the touch, and some of which may be poisonous. But in reality these cold-blooded creatures are of fascinating interest, provided they are studied properly." Thus Dr Gadow in his preface to this magnificent work, to which it is a great pleasure to direct the serious field naturalist's attention. We are inclined to think that amphibians and lizards receive a good deal of attention from field workers nowadays, and that the old prejudice against them is gradually becoming a thing of the past, no doubt due to the fact that the great interest of these creatures is more widely recognised. It is quite impossible within our limits to attempt any detailed account of this work, and it would be doing the book an injustice to select one portion and ignore the rest. Moreover, we shall have reason to quote its pages on many future occasions, as it must be regarded as *the* authority on the subjects taken up. We cannot agree with some of the statements made on the habits of our British species, as, for instance, the statement on p. 540 that the chief food of the slow-worm "consists of earthworms and snails." Considerable observation of slow-worms in nature has convinced us that they will feed on the common garden slug in preference to anything when they can get them. In cages, of course, they have to feed on what is given them. Neither do we quite agree as to the dietary of the ring snake, but these are simply differences of observation. The detailed distribution in the British Isles does not come within the scope of the work. Snake-venom is most interestingly dealt with, and the illustrations show many species. We should be glad to know that all field naturalists had this work on their shelves.

A TEXT-BOOK OF ZOOLOGY. G. P. Mudge, F.Z.S. Pp. 416. London: Edward Arnold. Price 7s. 6d.

Field naturalists who are also serious students of Zoology will find Mr Mudge's book a valuable guide to the study of certain types of animals. The dog-fish, the frog, and the rabbit are taken as vertebrate types, and compared with each other in all the various systems of the body, the resemblances and differences being tabulated for each organ. But for the ordinary field naturalist these chapters on morphology, pp. 30-216, are too advanced, and they will find certain other portions of the book more to their taste. The opening chapter on the Scope of Biology is excellent, and is followed by a discussion of the Characters of the Great Divisions of the Animal Kingdom. It is the latter part of the book which particularly appeals to field workers, and chapter xxi. on the Life-History of the Cockroach and the Butterfly, and their chief Structural Differences, should be read by all who would have a clear description of these. This chapter also ends with a table showing the differences discussed. We quote the following paragraph from p. 349: "Thus in the life cycle of the butterfly three distinct stages are passed through, but each is intimately related to the other: there is the active *larval stage*, during which the organism is feeding and storing up a reserve of potential energy; there is the apparently quiescent, in reality active, *pupal stage*, during which no feeding takes place, and the potential energy stored up in the previous stage is utilised in the formation of the imago; the *imaginal stage* is that of the perfect insect, which often only lasts a few days, a single day, or a few hours, and the chief, and in most cases the sole, event of which is the fertilisation and deposition of the eggs. The deposited eggs remain dormant during the winter, and develop into the larva in the following spring, and this will become the pupa, whence the imago will subsequently arise."

From this chapter the field naturalist will turn to the last two in the book, which deal with Heredity and Variation respectively. Under Heredity Mr Mudge discusses the experiments of Professor Cossar Ewart on horses, which show that the doctrine of Telegony is unsupported by experimental evidence. Our readers will remember that Professor Cossar Ewart dealt with his experiments on dogs in our last issue, and showed that his previous conclusions were only strengthened by these. We recommend Mr Mudge's book to the careful study of those field naturalists who wish to look a little below the surface in their zoological work.

In the February issue of the 'Naturalist' Mr S. Lister Petty has a paper on "Some Plants of Silverdale," West Lancashire, which gives a long botanical list for a little-worked district. The new species are *Salvia verbenaca*, *Centaurea cyanus*, which is an extension of range, *Epipactus atro-rubens*, and *Ceterach*, a rediscovery in the district. The formation of the locality is limestone.

AN ANNOTATED CATALOGUE OF EDIBLE BRITISH FUNGI. By E. W. Swanton. With six hand-coloured plates (comprising 52 figures) by E. W. Swanton and Miss Mosley. Pp. 43. Huddersfield: Charles Mosley. Price 2s. 6d.

This catalogue brings together in a succinct form an enumeration of the edible fungi contained in the two large orders of the Hymenomycetes and Discomycetes. It is of convenient size, and should therefore be of considerable assistance to the field worker, and its price places it within the reach of all. Mr Swanton seems to have sampled a very large number of our large edible fungi, and that he has survived the ordeal must be due to a remarkable constitution. Take two examples only. *Fomes* *fomentarius* (not *Formes*, as printed on p. 12) is a hard woody fungus, and was formerly much used for tinder before modern matches came into existence. *Entoloma sinuatum* (not *sinuata*) the present writer has always treated as poisonous on the authority of the eminent mycologist, Mr Worthington George Smith. He ate about a quarter of an ounce of this fungus, and the result was nearly fatal. It produced headache, swimming of the brain, stomach-pains, and vomiting. Has Mr Swanton any proof that *Cantharellus aurantiacus* is poisonous? We know of two persons who ate it with impunity, and the text-books say "reckoned poisonous." Are we to regard *Amanita stromboliformis* as a species new to science, or is this only a misprint for *A. strobiliformis?* Probably the latter, as we find *Polypooreæ* and *Mitrophora semilebra* on pp. 7 and 41 respectively. The plates are somewhat crude, as is to be expected from the price, and we recommend the artist to further study the magnificent paintings of Mr Worthington E. Smith at the British Museum.

Messrs Duckworth have in the press EUROPEAN FUNGUS FLORA: I. AGARICACEÆ, by George Massee, F.L.S., a work which is practically a synopsis of the European Agaricaceæ, giving the specific characters of over 2000 species of Agarics. Keeping in view the fact that the essential features of many Agarics can only be observed satisfactorily in the field, the present book will be kept within the limits of a field-book or hand-book, not adding much to the impedimenta of the traveller or tourist. In addition to the scientific descriptions, edible and poisonous species are notified, as are also those fungi which are known to be injurious to cultivated plants.

Field Clubs and Societies.

On March 22 the Essex Field Club celebrated its coming of age, and Professor Meldola, the President, delivered an address to the members. In the opening words of that address, "Not often does it fall to the lot of the same individual to be called upon to occupy the presidential chair after an interval of twenty-one years." That, however, was Professor Meldola's happy position on this occasion, a position which both he and the Essex Field Club are to be most heartily congratulated upon. His address dealt with the *personnel* of the club past and present, and then a review of the more important pieces of work which have been placed upon record in the volumes of the club's Magazine, the 'Essex Naturalist.' The list is an astonishing one, and emphasises what we have said elsewhere of the great value to the members and the public of these societies. It is quite impossible here even to indicate the subjects that have been dealt with, and we would advise all those in any way interested in the county of Essex and Epping Forest to obtain Professor Meldola's address, which has most rightly been reprinted. Probably no field club in the country numbers so many eminent naturalists among its list of members, and certainly no club has done more valuable work. When the Essex Club comes to its jubilee year, as the Woolhope Club has just done, may Professor Meldola once more be found reviewing the excellent scientific and educational labours of his society.

Sir Samuel Wilks, Bart., M.D., LL.D., F.R.S., has been elected President of the Hampstead Scientific Society, in succession to the late Sir Richard Temple. This society was founded in 1899, and now numbers no less than 235 members. Its main work is done in three sections—the Astronomical, the Photographic, and the Natural History sections. The indoor meetings for April and May applied particularly to the two latter sections, and included such subjects as "Flower Photography" and a "Demonstration on Silver Printing"; while the Natural History section had a paper on "Feathers, their Structure and Uses," an epitome of which we hope to publish in our next issue. The outdoor meetings for the spring and summer include two visits to Regent's Park—one to the Royal Botanic Society's Gardens, the other to the Zoological Society's Gardens. Astronomy should be a strong feature of the Hampstead Scientific Society, as the members are the possessors of a reflecting telescope of 10½-inch mirror, the generous gift of Colonel Heberden. It is erected in a small observatory on East Heath.

The annual meeting of the Woolhope Naturalists' Field Club was held in the clubroom in the Free Library, Hereford, on April 3. The general financial statement of the club was presented, and the position found to be satisfactory. Mr Pilley, the assistant secretary, presented his annual report, and the dates and places of the field meetings for the ensuing season were fixed. Mr T. Hutchinson brought before the meeting the question of the adoption of the Wild Birds Protection Act, 1894, within the county, and proposed the following resolution: "That the president be requested to bring before the county council the question of the Wild Birds Protection Act, with a view to its provisions being adopted in the county." This was carried unanimously. The retiring president, Mr T. Blashill, then delivered his presidential address, reviewing the club's history for the past fifty years, this being the fiftieth of the Woolhope's existence. Beginning with a very few members, the club has now grown to 240, and appropriately enough the jubilee year finds it with the largest membership on record. May the next fifty years prove equally progressive and successful.

The thirty-third annual meeting of the Norfolk and Norwich Naturalists' Society was held on 25th March. Dr Henry Woodward, F.R.S., late keeper of the Geological Department of the British Museum, was elected president for the coming session. Mr Bidwell, in proposing Dr Woodward, spoke of the long connection of the Woodward family with Norfolk; and Mr F. W. Harmer, in seconding, congratulated the society on obtaining such a distinguished scientific man as its president.

The president, Mr W. H. Bidwell, then read the annual address, in which he reviewed the work of the past year, which had been a prosperous one for the society, as evidenced by the increase in the number of members, the attendance at the meetings, and the papers contributed to the Transactions. The establishment of a fresh-water biological station at Catfield by Mr Eustace Gurney was one of the events of the year, as it was the first which had been inaugurated in England, though many were in working order in Europe and America. Mention of the pleasant excursions taken by some of the members last summer, and the enjoyment derived from the sights and sounds and scents of the country, suggested a few thoughts as to floral scents, to the consideration of which the remainder of the address was devoted. The classification of floral scents according to their chemical properties had been but recently attempted, but an outline was given of the five groups into which they were now arranged. Next, reference was made to the intermittent scents emitted by some flowers, and the difficulty of ascertaining how this was brought about. The advantages gained by plants from their perfumes were next considered, the chief of which was the allurements of insects for the distribution of pollen, whether sight or scent played the chief part in drawing insects to the flowers being a question much in dispute. The interception of radiant heat by their perfumes was a great advantage to plants growing in hot countries. The advantages to man of the fragrance of plants were shown in nervous diseases and the soothing effect of pleasant smells, and a short account was given of the art of the perfumer in extracting these from the flowers and in imitating them in compounds obtained from coal-tar products. In conclusion, the president spoke of the pleasure derived from perfumes, which recalled so vividly to our minds the scenes of bygone years, and remarked that in the enjoyment of these happy memories—

> " The present joys of life we doubly taste
> By looking back with pleasure on the past."

Correspondence.

" I see that in your first number you decline to believe that the adder ever takes to the water, and leave the *onus probandi* with me. I therefore venture to send you the following, which I took down in dictation from Ivaar Kriken, a young Norwegian with whom I have spent much time talking Natural History, both in Norway and in England, where he has been with me for some eight months. I have found him a keen observer and naturalist, and much above the average in the accuracy of his observations: 'In August 1898 I was fishing with a worm in Gusdalswand. I caught a brown trout of about a pound and a-half. It was rather big in the stomach, and I cut it open to see what was inside. I found a small snake, with a yellow-brown zigzag mark down its back. It was 6 or 7 inches long. I showed it to Hendrik Vicken, who owned the boat.' I know the farmer who owns the boat; he is not a person who troubles about natural history, and only swears to the snake. Though one can fish from the banks of this lake almost all round, the rocks in many places, though not high, are sheer, and it is quite possible that a young adder basking on the top of one may have fallen off and so met with its fate. But I give the statement for what it is worth."—J. L. Bevir, Wellington College.

"May I mention one or two incidents bearing on some points mentioned in the winter number of the F. N. Q. With regard to the 'thrush's stones' referred to by Mr Boycott in his most interesting article on 'Snails in Winter,' the following seems to show that a thrush selects a particular stone as its own feeding-place. Walking along a turnpike road I saw a common thrush carrying a snail to a stone on the road on which the bird attempted to break the shell. In this it was unsuccessful, so taking the mollusc in its bill again it flew over the wall into an adjoining field, where it broke the shell and devoured the contents. On examining the spot I found a stone about 6 inches in height with a round top, and lying around it as many broken snail-shells as would have filled a tumbler.

"In an editorial in the last issue a doubt is expressed whether the adder takes to the water. I have met with adders in water on two occasions. The first was when fishing in Blaydon Burn. I supposed I had secured a good-sized eel under a stone and so pressed it as hard as possible. Judge of my surprise when on landing it I found I had taken a viper. However, I took no harm, but carried it home in triumph. The second I saw swimming near Lannercost Abbey."—Thomas Thompson, Winlaton House, Winlaton-on-Tyne.

"In reference to your remarks on the ring snake (*T. natrix*) in the last issue of the F. N. Q., may I indorse them by the following? In August last, when going to play golf on our new links on Dartmoor (near Okehampton), I caught a fine *T. natrix* and gave it to my young daughter, who was with me, having first tied it up in a large handkerchief. Presently I caught a large frog, which I put with the snake in the handkerchief, placing them under the shelter of a furze-bush while I played golf with a friend who saw the snake and the frog caught, and both placed in the handkerchief. Picking up the handkerchief on the conclusion of our game, we found that the frog had disappeared, but a very brief examination of the snake showed that it had been so little disturbed by its new captivity that it had made a meal forthwith of its fellow-captive. This snake became a great pet of my little daughter, who is very fond of these animals.

"May I add that this last week two of my children have caught 24 vipers and ring snakes. All the vipers are of different shades of the same dun colour. The land here is 'dun,' and on it I have seen no other vipers but of this dun colour. At and near Jacobstowe we had red land, and many of the vipers there were of that beautiful red colour. I have not seen a single red viper here, but many dun ones. 'Dun' is the local name for the dark and rather unproductive clay soil."—Rev. Gregory Bateman, Bratton Clovelly, Devon.

"The reference to æstivation in serpents on p. 22 of the last issue of the F. N. Q. has a special interest to me, as suggesting a parallel case in the *Daphniadæ*. In these *Entomostraca* there is occasionally found a structure called the 'ephippium.' The ephippium gets its name from its close resemblance in shape to a saddle. It is attached to the inside of the hinge or junction of the two valves of the carapace, and is cast off when the animal next moults, or casts its skin. It used to be customary to call the eggs contained therein 'winter eggs,' and it was assumed that the object of the special thickened envelope was to protect the eggs from frost, although the structure was quite inadequate for such a purpose. Now, I have only occasionally come across any daphnias with the ephippium, but it is significant that in every instance the occurrences were in the summer, and in shallow water that was rapidly drying up. The inference is, I think, obvious—viz., that the special covering of the eggs is provided as a protection against drought, and for this it is no doubt perfectly adequate. I may add that the ordinary summer eggs are produced parthenogenetically, the ephippial eggs sexually. Males are rare in the whole order of the Entomostraca, and in some species have never yet been observed. Whenever I have found the ephippium I have found males present."—H. E. Forrest, Shrewsbury.

"In your interesting Reptile Studies in the F. N. Q., you allude to the adder's habit of swallowing its young ones as 'alleged,' so you will be perhaps interested to know that it has been observed repeatedly, and to be able to ascertain that the fact is not of uncommon occurrence. In the autumn of 1875, whilst shooting over the Landing Estate, Newby Bridge, at the head of Windermere Lake, my keeper, who was climbing the fell in advance of me, struck and crippled a large adder which was basking on a flat crag surrounded by a number of young ones. By the time I got to the spot the man told me that three of them had already gone down the adder's throat, and while I was watching, one by one all the rest did so. After a few minutes the old adder died, and the young came out one by one. We killed them as they came, only one escaping. We then had ten or eleven dead, I forget which number exactly. They were about 6 inches in length, and it seemed wonderful that they could have been packed simultaneously in the body of the adder-mother. The gamekeeper is still alive, and his name is John Harrison, Finsthwaite, Newby Bridge, and I have no doubt he would be able to produce the testimony of many others to more recent observations of the same fact."—Albert Piffard, Felden, Boxmoor, Herts.

(Our correspondent may be interested to know that during the last five years we have received over 150 statements of a similar character to his; but in spite of offering rewards—which the Editor of the 'Field' has also done for many years—we have never been able to obtain a specimen exhibiting the alleged phenomenon. We should be therefore extremely glad to "be able to ascertain that the fact is not of uncommon occurrence," by having a few adders with the young *in the gullet* sent to us during the coming season of reproduction.—ED.)

"Will you allow me to ask, through the medium of your excellent 'Quarterly,' the following questions ?—

"1. Of the three species of British newts, *Molge cristata*, *M. vulgaris*, and *M. palmata*, is any one, or are all, poisonous to those animals which venture to eat them ?

"2. Are these Batrachians provided with 'warning colours' on the under parts of their bodies ?

"3. What is the value of the suggested rule (to which there seem to be so many exceptions) in regard to 'warning colours'?

"Of course I remember the old saying that 'exceptions prove [*i.e.*, test] the rule.'"—Gregory C. Bateman, Bratton Clovelly, Devon.

(Correspondence is invited on the above point.—ED. *F. N. Q.*)

Answers to Correspondents.

Rev. D. H. DAVIES, Cenarth Vicarage, South Wales.

The four adders you sent were all young males (see p. 104). One was a specimen of the Black Adder (*Coluber præster*), so rare in this country. The only previous record of this adder is the specimen reported by you in 1901—*i.e.*, as far as South Wales is concerned.—EDITOR.

J. H. PEARD SIMKIN, Ewyas Harold, Herefordshire.

The curious fungus taken in your garden growing amongst grass under a slab of wood is reported on by Mr Carleton Rea as follows :—"A fine example of *Peziza ochracea* Boud, which is a somewhat scarce Discomycete. It measured 1½ inch (3-4 cm.) across, and so comes amongst the larger Discomycetes which attract attention in the spring. The majority of these are small in size, and are generally overlooked by the field worker unless he carefully scrutinises all old chips, rotten sticks, and old stumps. The dense interwoven hyphæ of the excipulum (the outer coat) and the branching hyaline paraphyses separate this species from its neighbours." The specimen was taken on March 22, 1902.

J. G., RALPH Q., F. B., N. R., and others.

You have all misunderstood the point at issue. It is not disputed that "throwing back" occurs in dogs,—that is a matter of frequent observation. It is the explanation offered by the theory of Telegony that is denied by Professor Cossar Ewart and other experimenters. In other words, the experiments mentioned prove that the fact of the "throwing back" is not due to the bitch having been infected by a previous mate, whatever else the fact may be due to. The theory of Telegony was advanced to account for the fact observed, and made to fit the facts like many other theories. Probably the "throw back" is due to an unknown and generally untraceable ancestor. Read the article carefully again.—Ed.

Young Naturalist's Quarterly Competition.

In order to encourage the study of natural history and other scientific subjects, the Editor offers prizes every quarter for the best essays sent to him on the prescribed subjects. The competitions are open to all young students and scholars, and are specially intended for the pupils of public schools, colleges, &c., which have natural history and other societies for their scholars. Competitors must send their essays in their own handwriting, together with a statement from their head-master or clergyman certifying the essay to be the original and unaided work of a competitor under nineteen years of age. Essays should not exceed 1000 words, but may be as short as desired. In awarding the prizes, the Editor, whose decision is final, will take into account both the accuracy of the matter and its arrangement. The result of the competitions will be announced in the following quarter's issue. The successful competitor must then select his or her prize from those offered, and inform the Editor at once where the prize is to be sent to.

The Editor reserves the right to publish any of the essays sent in.

Note.—The subject of the second competition is, **"Our Spring Bird Visitors: Where they come from, and why do they come?"**

Competing essays (with statement of age and originality) must reach the Editor of the 'Field Naturalist's Quarterly,' 17 Hartington Place, Edinburgh, on or before 20th July 1902. Envelopes to be marked "Competition Essay." The prizes will be announced in the next issue of this journal. First prize, any three of following books. Other prizes may be given.

Types of British Animals (Aflalo).
British Vertebrates (Aflalo).
A Walk through Zoological Gardens (Aflalo).
A Year with Nature (Westell).
Fauna of Shropshire (Forrest).
British Serpents (Leighton).
The Country Month by Month (Owen and Boulger).
Norfolk Broads and Rivers (Davies).
Design in Nature's Story (Kidd).
One Thousand Objects for the Microscope (Cooke).
Animal Coloration (Beddard).
To-day with Nature (Robinson).
The Vivarium (Bateman).
&c., &c., &c.

The First prize for the best Essay on "The Effect of Winter on British Bird Life" is awarded to Arthur Rinder, to whom the prize books will be forwarded by the Editor on receipt of letter selecting three books.

Notices.

TO CONTRIBUTORS AND CORRESPONDENTS.

ALL articles and other communications (typewritten if possible) intended for publication, and all books, Transactions, papers, &c., for review or other notice, should be sent to the Editor, 'Field Naturalist's Quarterly,' 17 Hartington Place, Edinburgh.

Business communications should be addressed to the Manager at 45 George Street, Edinburgh.

Contributors are requested to write the department to which their communication refers (*e.g.*, Ornithology) on the envelope.

Every effort will be made to return unused communications where stamped addressed envelopes are enclosed for that purpose, but contributors are advised to keep copies of their MS., as the Editor cannot undertake responsibility for their non-return. Photographs or other illustrations sent for publication must be original and the absolute property of the sender.

The full name and address of the sender must accompany every communication. Anonymous communications will not be noticed. Correspondence is invited on all matters of general interest which fall within the scope of work usually done by field clubs and kindred societies. Original observations on the habits of living animals and plants will be specially welcomed.

The 'Field Naturalist's Quarterly' will be issued in February, May, August, and November; and all communications for the ensuing issue should reach the Editor at least one month in advance.

TO SUBSCRIBERS.

The annual subscription to the 'Field Naturalist's Quarterly' is 10s. post free. Single issues 2s. 6d. each. Subscriptions, which may begin with any issue, should be sent to the Manager, 'Field Naturalist's Quarterly,' 45 George Street, Edinburgh.

The 'Field Naturalist's Quarterly' may be ordered direct from the publishers, Messrs Blackwood & Sons, or through any bookseller or newsagent.

Copies of No. 1 of the 'Field Naturalist's Quarterly' can still be obtained by new subscribers who wish to have the volume complete.

To Advertisers.

Applications for terms and spaces to be sent to the Manager, 'Field Naturalist's Quarterly,' 45 George Street, Edinburgh.

Special terms for selected places, or a series of (changeable) advertisements.

The Editor begs to acknowledge the receipt of the following publications:—

The Wellingtonian.
Cage Birds (four numbers).
The Yorkshire Weekly Post.
Lists of Summer Migrants (P. Westell).
Text-Book of Zoology (Arnold). By G. Mudge.
Further Observations on the Biological Test for Blood (Dr Nuttall).
Bird Migration in Great Britain and Ireland (Eagle Clarke).
The Naturalist—January, February, March, April, May.
Edible British Fungi, Annotated Catalogue of (Mosley). By E. Swanton and Miss Mosley.
Report of the Hampstead Scientific Society, 1900, 1901.
Fauna of Uppingham District (C. R. Haines).
Amphibia and Reptiles (Macmillan & Co.) By Hans Gadow.
The Essex Naturalist.

PRINTED BY WILLIAM BLACKWOOD AND SONS.

From a Picture by Frank Southgate.

A PROMISE OF OCTOBER.

The Field Naturalist's Quarterly

Vol. I. AUGUST 1902. No. 3.

Editorial.

During the last thirty years of compulsory education Nature Study has taken a place in our Elementary School Codes in various guises, perhaps one might say disguises; for doubtless the teacher who had the root of the matter in him could have employed the "optionals" of Botany and Agriculture of the Codes of the 'Eighties, and the Elementary Science "compulsories" of the 'Nineties, of which teachers spoke so much and expected so little; or he could even have made a "voluntary specific" of either had he so chosen. Why the teacher did not force the Education Department to put Nature Study in the New Code (1898) instead of being forced by the powers to take up nature teaching *nolens volens*, may be accounted for in various ways. It may be because only within the last five years has Nature Study been included in the Training College curricula, and it may also be for other reasons concerned with the Department bringing themselves into touch with Swiss, German, and American schoolwork on the Nature Study lines.

Whatever the reason, the parlour botany of the young ladies' finishing school, the illustrated-chart botany of a few elementary schools (which had as its climax the calling of the gowan by the expletive *Chrysanthemum leucanthemum*), the practical and sound botany of those schoolmasters possessed of backbone and a farm or glebe whose cultivation was largely the outcome of compulsory labour,—these constitute in this subject the whole tale of day-school work.

Agriculture and its teaching depended so much upon the whim of the inspector, who might look on unconcerned while violets were fed with extract of beef, but would shudder at the wrong scansion of "arma virumque cano," that teachers who could do this nature work well were forbidden to touch it, or had grants reduced so that it did not pay. Obviously the education of the inspector was the first desideratum ; and while the Education Department now compel teachers to qualify themselves, it is quite within the bounds of possibility that the inspectorate need not know the work so well as the teacher, the value of whose instruction they are intrusted to appraise.

The solution of the problem, in our opinion, lies in a university degree for teachers, the curriculum to include a group of sciences. At the present time Nature Study is, throughout Scotland, compulsory,—gently, indeed optionally, compulsory: just in so far as the particular district inspector is interested in the work he is sent to criticise. Excursions to gardens, museums, places of industry and interest, walks by the wayside, with here and there some practical gardening or farming, are all permissible and considered as school-work. We regret, however, that while in certain parts exceptionally good work is done in country districts, where land is easily got, school-gardens are practically non-existent —we apologise for being unable to name the exceptions here; and in the cities and towns the teaching of the subject on rational lines is often a dead letter, again with honourable exceptions.

The Schemes of Instruction are drawn up by the head of each school, and usually include Physics, Dynamics, Chemistry, Zoology, Entomology, Geology, Botany, Local Industries, Practical Measuring, and Weather Observing; but all in such infinitesimal quantities that the sum-total is absolutely negative as serious training. It would be interesting to have the following questions answered by inspectors and teachers: What average percentage per month of children over ten years of age in your school took part in any excursions whatever beyond the school walls? In how many of the schools examined did any pupils take part in practical work, including the collecting and mounting of specimens? What proportion does this number of children bear to the whole under Nature Study instruction? In how many schools was Nature Study made the subject of examination? That this branch of national education is deserving of most serious attention hardly needs to be restated; utilitarian, sanitary, æsthetic, and ethical considerations all weigh in its favour, and the fact that it has been put in the code curriculum is evidence that elsewhere it has proved of value.

What about the future? The child has to be made to feel himself a citizen of his native land, that he is the heir to historical facts, that as a man he has a duty to perform to his race; that bird, beast, and flower stand similarly related to their common native land. And in order that the individual may correct and readjust his relation to things external, a wide range of sympathy and knowledge of living nature is essential: from the home to the locality, from county to country; from pets and things of æsthetic value to biology with reference to economics; from the position of isolated unity to that of citizenship of the world,—this is "concentric" method.

It is with every sympathy with the arduous task of the teacher that we pen these words; and it is also with the hope of aiding a little towards better co-ordination of the abundant energy that exists in teachers themselves, intelligent parents, Field Naturalist Clubs, and the keen ardour of young life. We first want an inspectorate thoroughly in sympathy with the Education Department's ideas, with the work itself, and with the limitations and opportunities attending the carrying on of the work; and along with this a class of teachers who have had some chance of realising what Nature Study is and can be made, and who appreciate the fact that we live in an age of new ideas and great thoughts, and who will apply their intellect to the best method of imbuing scholars with their own enthusiasm.

And that the blame for the cold harvest of result in

Nature Teaching is not due to the initiative of teachers being cribbed, cabined, and confined by departmental freezing, we in fairness must assert; for even so early as '73 we find a footnote to Schedule IV. in reference to the teaching of Nature Science (Chemistry, Botany, Animal Physiology, and Physical Geography): "If these subjects are taught to children by definition and verbal description instead of by making them exercise their own powers of observation, they will be worthless as a means of education."

We modestly submit, therefore, that the fault is not at the fountain-head, and that the channels of the stream ought to be carefully examined as to the cause of obstruction.

In the first place, then, schemes of work must be made out, not for rhetorical effect but for practical use. If the head of a school took as his scheme for the year an exact *résumé* of what had actually been accomplished in the previous year, and added to that, what expanding experience, love of the subject, and ever-widening sympathy between teacher and pupil would accumulate during the months in which the work was taken up, he would have a code self-constructed, real, living, and progressive.

What subjects are to be included in such a scheme must to some extent be dictated by the locality: but domestic and wild animals; domestic and outdoor insects; plants, garden and wild; the food and enemies of all these,—must, we think, find a prominent place in every scheme of Nature Study.

If children be asked to write a table of all the quadrupeds, birds, creeping things, flying insects, fishes, plants (flowers and trees), which they have ever seen and can recognise, the teacher will be startled to see the microscopic result. This surely indicates one direction in which knowledge is wanted. The instructor should follow by indicating how each and all of these contribute towards or subtract from man's existence or happiness. The life-history of the type of each group should be studied by actual observation without going into minutiæ. Specimens collected should not be consigned to a museum for the purpose of saving trouble next year. Only those of outstanding merit or exceptional interest should be preserved. Here the specialists usually connected with the local Natural History Clubs should be appealed to; and they will be able and, we are sure, willing coadjutors in the management of excursions. Each child should do some direct observation, such as tracing the life-history of an insect throughout its successive stages, and should mount the stages; find out upon what each feeds and what will destroy each, and the duration of the metamorphoses. The value of such work is inestimable, creating a power of doing solitary research (for what each does alone and for the first time is original research), and this gives character to be attained in no other way. To grow any flower in its season, and to write down its history from day to day, is Nature Study enough for one child for three months, provided he alone does the work. In this study teacher must progress with pupil; and if the teacher be the right man in the right place, and have the same pupils through several years till he leave his mark upon them, he has then had a chance of giving his pupils something that deserves the name of "education."

* * * * *

The explanation of the phenomenon we term Heredity is a matter to which biologists are devoting much attention at the present time. Of all the problems of biology this is perhaps the most fascinating, and therefore, as one would expect, many theories have from time to time been formulated to account for the facts observed. But modern research has demonstrated that we are still far from a full understanding of the phenomenon, and it still remains a wide field for experiment and observation. The average man associates heredity chiefly with the animal kingdom, but the question is equally interesting from the side of the plant world. Moreover, while comparatively few individuals have the opportunity of carrying out the necessary experiments on animals, it is open to all who possess gardens and greenhouses to make very detailed notes of the variations and hereditary characters in plants. Our object in drawing attention to the subject here is to stimulate the interest of botanists in the problem, in the hope that some of our readers may be induced to first make themselves acquainted with current thought and literature on heredity, and then proceed to make experiments and record their observations. Every additional fact recorded helps towards the solution of such questions. Finally it is reserved for some master mind, surveying the whole mass of facts which have from time to time been established, to appreciate the one essential element running throughout, to perceive the true proportion of varying results, and to lay bare the one principle which underlies the whole. Apart altogether from the practical results obtained, the botanical observer will find it a most interesting study to observe which characters of plants are the most frequently transmitted. He may produce variations either by altering the quantity and nature of the nourishment on which the plant lives, or by crossing one plant with another. It will be found that those variations which result from crossing are more often transmitted than those induced by the former method, and the line of observation thus indicated will provide interesting work for all who appreciate true nature study.

* * * * *

Of the multiplication of new societies there seems to be no end; but in so far as they are concerned in spreading the love of natural science and in aiding in its study, we welcome them and wish them all prosperity. One of the latest is the World-wide Naturalists' Society, whose headquarters are in Glasgow. The idea of establishing a connecting-link between observing naturalists in widely scattered areas is an excellent one, and we shall watch the development of this society with interest. A vast amount of energy will be required to carry out the intention of the promoters with anything like success, but we have no right to assume that this will not be forthcoming. The subscription is nominal in amount, and we hope that our readers will give the new society their support.

* * * * *

All field naturalists are interested in the best means of protecting and preserving, and even restoring in some instances, our native birds. We therefore commend to the serious consideration of our readers the question of establishing a Bird and Arbor Day as an annual institution in the British Isles, which is dealt with elsewhere in this issue. We invite expressions of opinion on the means suggested, from private individuals or corporate bodies, and shall be glad to open our columns to free discussion of the matter. At present we refrain from expressing any opinion on the feasibility or otherwise of the proposal, recognising that there is much to be thought of before a definite scheme can be decided upon. But there can be no doubt that the question is a pressing one, and all proposals which are at all practicable should be carefully weighed. The first thing is to educate the rural public to see the need of more intelligent bird protection, and to get landlords to take a real interest in getting as many wild birds as possible to nest on their properties. The Society for the Protection of Birds has done and is doing excellent work in this matter, and they have the sympathetic support of many well-known naturalists and landlords. The Secretary (3 Hanover Square, W.) will be glad to give any information to those who are willing to join the society or any of its many branches, and to supply literature on the subject. To those of our readers who have trees and buildings of their own we commend a careful perusal of Mr Masefield's book, noticed in another column.

The Establishment of an Arbor Day.

By Reginald Haines, M.A., M.B.O.U.

Arbor Day, or Tree Day, is an American institution which it is proposed to naturalise in England. It appears that on a given day the inhabitants of one or more townships sally out and each individual plants a tree in the ground selected beforehand by the community for this purpose. No information is forthcoming as to how the site is chosen, who gives it for this object, and what trees are selected and by whom. It will not be amiss, however, to discuss the possibility and advisability of establishing a similar institution in our own country, now that the Society for the Protection of Birds has suggested an Arbor Day in connection with the encouragement and protection of birds.

The question with which we purpose to deal in this paper is not the afforesting of the six million acres in the United Kingdom, which could be redeemed from the condition of being waste lands and made to pay 2½ per cent, but the much smaller and simpler question of planting trees in suitable places by an organised effort on a particular day in each year. In fact it is not forestry, or even sylviculture, but arboriculture, which is in question.

The objects of forestry are to put waste lands to effective use and to produce timber that will be financially profitable, and only in a secondary degree to beautify the country and modify its fauna or its climate. In fact, forests grown on sound economical principles are by no means so picturesque and ornamental as neglected woodlands and parks full of gnarled oaks, hollow pollards, and immemorial elms.

At first sight it seems a most taking idea to set apart a day for planting trees to beautify the landscape and encourage birds to multiply in the land. But the most superficial study of the question suggests many practical difficulties at the very outset. Who, for instance, is going to give the necessary land for planting? Where is the money for the trees, which in the aggregate would amount to a considerable sum, to come from? Who is to decide the species of tree to be planted in each case? Private enterprise cannot be expected to find the land and present the trees as a permanent gift. Desultory and partial tree-planting would not be of the smallest use, and would merely bring the whole movement into contempt and premature decay.

The Bird Protection Acts, though brought out under the ægis of Parliament and made a national concern, are full of absurdities. They are framed and worked on radically wrong and inefficient principles. Birds such as the kingfisher are not sufficiently protected; birds such as jackdaws, crows, rooks, and magpies are accorded a protection to which they have no claim. Moreover, the Acts, such as they are, are seldom enforced, and then not against the chief offenders or with sufficient penalties.

All those, therefore,—and they are many,—who wish to carry out this excellent idea of a Tree Day, must consider how this can be done by an association such as the Society for the Protection of Birds without incurring the risk of a fiasco similar to that of the Bird Protection Acts.

It must be remembered, in the first place, that no satisfactory planting of trees, or in fact any real planting of trees at all, can be carried out except by the consent and under the auspices of the large landowners, or the District and other councils.

Let us take the latter first. In rural districts the Councils have a perfect mania for lopping trees and grubbing up or cutting severely back all the beautiful old hedges which form the chief ornament of our country scenery, and constitute the larger part of the shelter available for birds in such comparatively woodless districts as the Midlands. All this vandalism is perpetrated on the ground of utility. Farmers are taught that tall hedges injure the crops, whereas in fact they benefit and nurse them. Roads are supposed to deteriorate because the hedges prevent moisture from drying off them. Meanwhile many parts of England, more especially the Midlands, suffer year after year from severe droughts. In Germany the State insists upon apple, plum, and pear trees being planted along the highways, affirming that the produce from these goes far to maintain the roads in repair. Some districts sigh, and sigh in vain, for the cool sheltered lanes of Surrey and Devonshire, and other counties, where a more intelligent view is taken of rural matters. Apart from the beauty of hedges and hedgerow trees, they are a great comfort in hot weather for their shade and in bleak weather for their shelter.

The above being the attitude of the County and District Councils, we may be prepared to find that if an Arbor Day be established, they will, at all events at first, be opposed to it.

Since the Commons' Enclosure Act in the earlier part of the nineteenth century, which followed the maxim of giving to the rich who had and taking from the poor even the little they might have claimed to have, there is no common land available in most places for the purpose of tree-planting. The only lands which could be made use of for such purposes are—

1. Roadsides, the more or less wide border of grass found in many country places along the roads;
2. Little unconsidered corners and plots in and around country towns and hamlets;
3. Village greens and village commons;
4. Railway embankments;
5. Churchyards and cemeteries;
6. Lands specially granted by landowners for the purpose.

Let us consider these in order.

1. In order to plant roadsides, the various Councils would have to be persuaded or coerced into abandoning their absurd crusade against shady roads. Also the lord of the manor might have a say in the matter. The senseless practice of "layering" hedges, encouraged by the Councils, does more to destroy the beauty of hedgerows, to impair their efficiency as fences, and to ruin their utility as bird-coverts, than any other system of high farming now in vogue. A full well-trimmed hedge of quick or hornbeam, of beech or holly, with the moist ditch below it, gives an ideal shelter and nesting-ground to more than a score of our most desirable birds. Of one species, the red-backed shrike, it is the favourite nesting-ground. To utilise the roadsides would be the most convenient and practicable method of carrying out a systematic planting of trees near country towns and villages.

2. But a beginning might be made experimentally upon the little corners and plots mentioned as a second alternative. Here, too, leave would have to be obtained from some local authority or landowner. Old pounds, generally the receptacle for garbage of all sorts, might be converted into something much more picturesque and financially useful.

3. Then there are the village greens and commons. Here common rights of grazing cattle and geese would have to be considered, and moreover, if this difficulty were surmounted, great care would be necessary to prevent the beauty of such open spaces being impaired by want of judgment in the planting of the trees. Only a few favoured spots, indeed, have any such common lands.

4. Railway embankments undoubtedly afford a good field for tree-planting on an extended scale, but of course it is not in the least to be expected that railway companies either could, or would, consent to this being done systematically on their land, even if the trees so planted became their property, as they would naturally do. Still, if the plan proved at all feasible, it would answer the purpose for which such planting is intended well enough. Many birds by choice frequent railway embankments and cuttings, owing perhaps to the abundance of insects roused from their retreats by the passage of trains past them. Moreover, birds would be safer, and could nest more securely, where trespassers are few.

5. Lastly, of lands already available for our purpose, there are the churchyards and cemeteries, "haunts of ancient peace," and well suited to the requirements of birds. But these, too, are in the hands of clergymen and local bodies, whose tendency is to lop and mutilate rather than to encourage the growth of trees. They would be very unlikely to permit such lands to be systematically planted. The cypresses in Turkish graveyards are famous for their stately beauty, and no doubt harbour and nestle many of the smaller birds. If anything could be done in this connection to induce poor people to substitute shrubs and trees for those hideous mockeries of sorrow—the glass shades with sham flowers—that deface our lovely churchyards and degrade the sacredness of grief, great would be the gain from the moral and æsthetic as well as from the ornithological point of view.

6. Besides the above-mentioned, the only way of obtaining the necessary land is by direct permission from some owner, who again would naturally reserve the right of property in the trees planted. He would hardly give any considerable amount of land away to others in perpetuity.

If an Arbor Day were established as a *national* observance, no doubt the local authorities could, and would, be forced to carry out the requisite duties in connection with it, and so public lands and funds could be utilised. But it seems hopeless to expect attention to such matters from our overburdened Parliament. If then, failing this, private bodies attempt to popularise such an observance, they can only do so by degrees and to a limited and tentative extent. Every member of such an association could engage to plant one tree or more every year in his own grounds or garden, supposing he had any, and also to plant a tree for every one he cut down. It is a law in Germany that every tree cut down must be compensated for by one planted.

Two other points require decision. First, Which day shall be chosen as the Arbor Day or Tree Day? The choice lies between All Saints' Day (1st November), which may be too early, Christmas Day, February 14, birds' pairing day, according to the popular folk-lore, or Lady-day, the beginning of the ecclesiastical, as formerly of the civil, year. It is, however, impossible to plant trees when the ground is hard with frost or drought, and, on the whole, Christmas Day would seem to be the most suitable day for the purpose, as there is seldom any hard frost by then, and the ground is otherwise moist.

Secondly, What trees are to be planted? This would require much consideration. Knowledge of sylviculture would have to be combined with knowledge of ornithology before a satisfactory selection could be made. Certain birds are attracted by certain trees—for instance, crossbills by conifers. If a district is overrun by one particular sort of tree, such as the ash-tree, a tree financially profitable, but only suited for bird-life when hollow, then trees of a different sort and more suitable for birds should be selected. Here it may, in passing, be not amiss to raise a protest against the utter want of originality displayed in planting the London streets and embankments. Because plane trees are able to shed their bark, and so throw off the deleterious effects of smoke, therefore no other trees but planes are planted. No experiments appear to be made to find out what other trees would do in London. Willows, aspens, and sycamores seem to thrive in spite of smoke. Plantings, when necessary, might in future be made more impressive if the authorities in London and other towns carried them out on the day fixed for Arbor Day, so that they might share in the observance of such an anniversary. The difference lately made to bird-life in London by the judicious planting of such parks as Battersea has been enormous. That kingfishers should breed successfully in Battersea Park, and a cuckoo lay her egg there in a warbler's nest, is indeed a matter for great encouragement to all bird-lovers.

The long-eared owl hankers after spruce firs for its nest; the wood-wren requires a wood of tall oaks or timber trees for its concert-room; the nightingale loves the copse or thick covert for its shelter; the siskin clings to its favourite alder; the brambling haunts the beech; the Dartford warbler hides in the gorse; and many species, such as the goldfinch, cluster round the orchard.

A committee of experts would have to decide what trees or shrubs should be planted, and a healthy rivalry might spring up and be fostered between hamlet and hamlet, town and town, as to which should lay out its hedgerows, its waste places, and its woods most effectively and ornamentally. The young generation that planted would live to see the fruit of their labours, and England, that "demi-paradise," would become a paradise indeed.

Feathers: Their Structure and Uses.[1]

By Basil W. Martin, F.Z.S., M.B.O.U.

Birds possess a form of covering which is unlike that of any other animal—namely, feathers. My object in this paper is to describe their structure, modifications, and some of their uses. Feathers are something akin to hairs in mammals, but are infinitely more complicated and elaborate, and may be termed "complex hairs of a conical form which are split up into a definite pattern." They are, in truth, the most peculiar and most complicated skin appendages possessed by any animal.

There are many different kinds of feathers, but they are all more or less formed on one ground-plan. A feather is an elongated structure with a hollow stalk—the quill or calamus, and an expanded distal portion—the vane or vexillum. At the bottom of the quill is an aperture called the umbilicus inferior, into which fits the small prolongation of the skin—the feather papilla. There is another much smaller aperture at the junction of the quill and the vane on the inner side of the feather—*i.e.*, next to the body of the bird.

---

[1] The substance of a Paper read before the Hampstead Scientific Society (Nat. Hist. Section) on the 9th May 1902.

A small tuft of down at the top of the quill represents the after-shaft of some birds. The vane has a mid-rib or shaft, the rachis, which is a continuation of the quill, but is different from the latter inasmuch as it is solid. On each side of the shaft there is a kind of membrane, forming that part of the feather which is expanded, and which is composed of flattened and expanded plates, called "barbs." On the sides of these barbs there are small processes or "barbules," which have much the same relation to the barbs as the barbs themselves to the shaft. Thus a feather is able to present a continuous surface for flight or other purposes. A simple way of demonstrating this is to rub the finger and thumb down a feather from the tip, when the barbs will separate, and then by reversing the process the barbs will regain their normal position. The exact way in which the barbs interlock can be made out only under the microscope, though the barbules can be seen with the aid of a pocket-lens. Under the microscope there will be seen—in addition to the barbules—a further series of hooklets or "barbulets" extending from the lower edge of the anterior barbules. These hooklets interlock with the posterior barbule immediately below them.

Sometimes a second shaft, called the "after-shaft," may spring from the top of the quill, and is usually a small representation of the ordinary shaft with its vane. In some feathers the after-shaft is always wanting, as in the wing and tail feathers; while in some birds which possess an after-shaft to some of their feathers it is as large as the feather itself. A number of species of the great order Galli, or Game Birds, possess after-shafts, while numbers of birds do not.

Feathers, like scales, arise in the embryo from papillæ of the skin, formed of dermis with an epidermal covering. The papilla becomes enclosed and sunk in a sac,—the feather-follicle,—from which it later on protrudes as the feather-germ. The horny layer (*stratum corneum*) of the epidermis forms a sheath, which is, however, only temporary, and which is thrown off as the feather grows and expands. As the feather-germ grows the cells of the Malpighian layer begin to proliferate and give rise to a series of vertical folds, which are arranged along a central axis, and which extend inwards to the pulp. These folds, which are surrounded by the horny sheath, become cornified and separated, and by drying of the pulp gradually give rise to a tuft of horny barbs.

The majority of birds are hatched with the feathers in this state, which look uncommonly like hairs. The surrounding horny sheath splits and the barbs become free, and if they are all like one another a down-feather has been formed.

The lower part of the feather-germ remains embedded in the skin and forms the quill. The down-feathers may remain as such throughout life, or may be replaced by regular feathers. A second follicle, or sac, is gradually developed below that of the down-feather with which it is connected. The papilla which develops inside this new lower follicle quickly grows and pushes the down-feather out of its follicle, or pocket, and comes to the top. Each feather at first resembles a down-feather in structure, but in course of growth one of the barbs becomes thickened and forms the shaft, or rachis, to which barbs are attached.

The ordinary feathers which cover the body are called contour feathers, because they indicate the form or shape of the body. They have generally soft barbs at their base. Many birds have a more or less quantity of down, which is made up of very soft feathers, sometimes having an after-shaft, and sometimes having not even a shaft at all; in this case the soft barbs diverge from the top of the quill.[1]

---

[1] A number of birds, when young, pass through no downy stage at all; such are the whole orders of Woodpeckers, Cuckoos, and their allies, and the Pigeons. The majority of the large order of Perching Birds (Passeres), of which the sparrow is a type, pass through no downy stage—an exception being the lyre-bird of Australia, the young of which are hatched thickly covered with down. Young birds which are always covered with down are the Game Birds, of which the domestic fowl is a conspicuous example.

Thread-feathers, or "filo-plumes," are very much like hairs, and are long and narrow, the vane being quite rudimentary. Some of these thread-feathers are bristly, or setaceous, and many birds possess a row of bristles, vibrissæ, along the opening of the mouth or gape. These are conspicuous and very long in the Goatsuckers, and the Flycatchers have them in a lesser degree.

Feathers are liable to become damaged in the wear and tear of constant use, and to meet this contingency they are able to be easily cast and replaced by fresh feathers. This process, moulting, takes place just after the breeding season as a rule, and it is present among all birds from the ostrich to the humming-bird.

If the feathers of the wing and tail, which are used in flight and which must become damaged, were not renewed the bird would be unable to fly; but, on the other hand, if they were all shed simultaneously the event would be the same, so that the flight-feathers are usually shed in pairs, and in this way the bird is still able to seek its food or escape its enemies. The large order of Ducks, Geese, and Swans are, however, an exception to this rule, for most of them shed all their quill-feathers at the same time, and are thus for a short period unable to fly. But in the case of ducks, their mode of living is such that they have other resources for concealment and escape. Their food can be obtained in or near water, and the aquatic plants and herbage serve them as an easy and effective shelter.

Swallows moult in the spring, which is uncommon. A number of birds have two moults in the year, and there are even some species which have three. Thus the Ptarmigan (*Lagopus mutus*) moults three times in the course of a single year. The first moult takes place immediately after the breeding season, as is usual, both male and female becoming grey in colour; they then moult again and become white for the winter, and in spring moult for the third time, adopting the plumage of the breeding season again.

The second moult in some birds is often very partial and limited to certain parts of the plumage, and it is still a moot point as to how far some of the changes are due to actual moulting or how far to the alteration of colour in the feathers themselves, and also as to how this alteration is produced. This may happen by abrasion,—that is, the wearing away of the barbulets or hooklets of the barbs,—and there are some who say that the colour pigment of the feather itself changes.

The young of a great many birds do not shed the quill-feathers in the first year, nor do many seem to have a complete moult during that period.[1]

Feathers do not grow all over the body of a bird, as every one who has plucked a fowl will know; but are found in certain distinct tracts, the forms and peculiarities of which are very different and characteristic of various birds. This, however, does not apply to down. There are a few exceptions to this; thus the ostrich, toucan, and penguin have feathers growing all over their bodies.

Having given an outline of the structure and modifications of feathers, we will now endeavour to see some of the uses to which feathers are put by the birds themselves. Every one knows that a number of birds line their nests with feathers from their own bodies, and the eider-duck practically builds its entire nest of down from its own breast, which is of considerable commercial value. To enumerate the great number of cases of brilliancy in the plumage of the cock birds, and their habit of "showing off" before the hens, does not come within the scope of this paper. We may mention, in passing, the peacock, pheasant, turkey, argus-pheasant, and a whole host of Game Birds, whose habits of flaunting their tails and "showing off" their plumage, by strutting up and down before the hens, are too well known to need description. The great bustard, which was once common in parts of England, is a striking example, and if any one has seen the cock bird "showing off" before the hens, as I have done, he will know what an extraordinary and never-to-be-forgotten sight it is. Darwin's theory is that the brightest coloured and best formed male birds of any species are chosen in preference to others by the females, and so tend to perpetuate their peculiarities, while the weaker and less brilliant go to the wall. Then, again, the plumage of many birds closely resembles their natural surroundings; examples are found among a number of the Game Birds and others, such as woodcock, grouse, ptarmigan, snipe, curlew, sandpipers, plover, and many more.

---

[1] When the plumage of the two parent birds is different from one another, the young birds resemble the mother, the exception to this being that when the hen bird is more conspicuously coloured than the cock the young are coloured like the latter. When the parents are alike in plumage the young are different from them both.

A word concerning some of the uses to which feathers are put by man.

Firstly, for bedding and upholstery. The down of the eider-duck, as is well known, is used extensively in this direction. The feathers of swans, geese, ducks, domestic fowls, and the rest are used principally for bedding.

Secondly, for writing purposes. The earliest period on record when quill pens were used for writing was in the sixth century, and they continued to be the chief kind of writing instrument until steel pens were introduced. Hence the name "pen," from the Latin *penna*, a feather. The quills for this purpose are best when taken from living birds in the spring, and the goose furnishes by far the largest number. The swan, crow, eagle, hawk, owl, and turkey are also made use of, both for pens and for camel-hair brushes. The five outer wing feathers are the ones which are used, and those of the left wing in preference to those of the right, because they would curve outwards away from the writer.

Feathers as ornamental decorations did not come into general use among, what we must call, civilised nations until the thirteenth century. They were in great demand during the reign of Elizabeth—ostrich plumes being in greatest request. It is needless to say that among savage and half-civilised races feathers are still the chief decorations for head-gear, &c., and I have seen them in use among the North American Indians.

I cannot leave the subject of feathers for head-gear without saying something about the cruelty involved in procuring the feathers of the various kinds of egrets and herons—called by milliners "ospreys." The different species of herons, notably the little egret, only have the "plumes" during the breeding season, and they thus form their "nuptial plumage."

When this plumage is at its best the young birds are hatched, and then the plume-hunter comes with his gun and shoots down all the parent birds, leaving the miserable young birds to perish from starvation and cold. If only women would give up wearing "ospreys" there would be no demand for them, and consequently the rapid extermination of the birds would cease.

Reptile Studies.

By GERALD LEIGHTON, M.D.

IV. SUMMER—THE SEASON OF REPRODUCTION.

IN our last issue we saw that the season of spring was marked by the resumption of activity on the part of reptiles, and we especially noted the spring sloughing, the process of feeding, and finally the fact that pairing takes place at the end of that season. Following out the life-history of these creatures, we now turn our attention to the phenomena of reproduction which are associated with the summer season, and also partly with autumn.

Reproduction in reptiles takes place in one of two ways: either by the deposition of eggs at an early stage of development, or, secondly, by the bringing forth of young fully developed and able to look after themselves from birth. Those reptiles which reproduce by the former method are termed oviparous, while those which bring forth their young alive are said to be viviparous or ovo-viviparous. The two last terms are synonymous, but the last is perhaps the better, as it expresses the additional fact that the young have been carried to full time in an egg-membrane. We have examples of both of these methods of reproduction in the six British reptiles,[1] in fact both our snakes and lizards include oviparous and ovo-viviparous members. It may perhaps be convenient to indicate at once how this feature is distributed among them.

[1] The green lizard and the wall lizard of the Channel Isles are excluded.

BRITISH REPTILIA. (REPRODUCTION.)

I. OPHIDIA, SNAKES.

1. *Vipera berus*, the adder, is ovo-viviparous.
2. *Tropidonotus natrix*, the ring snake, is oviparous.
3. *Coronella austriaca*, the smooth snake, is ovo-viviparous.

II. LACERTILIA, LIZARDS.

1. *Anguis fragilis*, the slow-worm, is ovo-viviparous.
2. *Lacerta vivipara*, the common lizard, is ovo-viviparous.
3. *Lacerta agilis*, the sand lizard, is oviparous.

It is thus seen that we have one snake (the ring snake) which deposits eggs; and one lizard (the rare sand lizard) which likewise reproduces by the oviparous method. The remaining four reptiles are all ovo-viviparous, bringing forth their young alive.

The mention of the two methods of reproduction naturally suggests the idea that some reptiles are like birds in this matter, whilst others—those which bring forth living young—approximate more to the mammals in this particular character. But the resemblance is more apparent than real, especially in the case of the ovo-viviparous members, in which the reproductive process differs essentially from that in the higher mammals. In the reptile the growing embryo is in the egg during the whole period of development, deriving its nourishment from the yolk of the egg, and rupturing the egg-membrane when fully developed. This condition is actually found in the lowest mammals, the Monotremes of the Australasian region, which in their reproduction approach the reptilian type; but these peculiar creatures are oviparous, laying or depositing eggs after the manner of the ring snake. The process in the adder and other reptiles which bring forth living young is not at all comparable to the process in the higher mammals, and indeed the main resemblance is that these reptiles retain their eggs in the body during development instead of depositing them exteriorly. The nourishment is still derived from the egg yolk, not by means of the special organ, the placenta, which serves to nourish the mammalian embryo.

The egg-deposition of the oviparous reptiles is also different from that of birds, in some species at least. Thus the ring snake may deposit a considerable number of eggs at once, these eggs being adherent to each other by means of a glutinous secretion, and hence are often found *en masse*. A ring snake in my cages last summer deposited fifteen eggs in one day in this manner, and seven more on the day following. Sometimes a number of eggs are deposited at intervals of several days, at other times all are extruded at one time. Then again some snakes' eggs exhibit the very curious phenomenon of becoming larger after being deposited, as do those of some lizards. The ring snake is an instance of this peculiarity also. As Dr Gadow says, "This is explained by the growth of the embryo, which stretches the shell and does not merely live upon the contents of the egg itself, but also takes in air and moisture."[1] The possibility of this being done is due to the nature of the eggshell, which is not really a shell, but consists of a tough leathery membrane, pervious to air and moisture. It is generally supposed that the ring snake takes no further interest in the reproductive process after depositing her eggs; certainly she does not incubate them in a state of nature. Mr Linnæus Greening, however, had a ring snake that always incubated her eggs in captivity, another curious instance of the effect of captivity on the habits of snakes, a subject we discussed on a previous occasion. The favourite place for the deposition of these eggs is a manure heap, the fermentation of which provides the heat requisite for rapid development. But any heap of rubbish is apt to serve as an incubator, and cucumber frames and corners of greenhouses are also occasionally selected. The period of development varies somewhat in length, according to the circumstances in which the eggs are placed, but as a rule is about eight weeks from the date of deposition. Some ring snakes' eggs, however, do not hatch until the following spring if deposited late in the summer or autumn.

The usual time to find recently deposited eggs is towards the end of June or early in July, the time varying with the locality (*i.e.*, the temperature) and the character of the particular season. In a summer (?) like the present we may well pardon the ring snakes if they seem unable to decide whether it is worth while to deposit any eggs or not, and at the date of writing (July 14), as far as my reports from different districts go, practically no eggs have as yet been deposited, though it is past the usual time. These climatic changes must have a very far-reaching effect on the prospects of the young reptiles, a point we may refer to in the autumn. But if all goes well, the young ring snakes arrive in considerable numbers about the end of August or early in September, measuring from 6 to 8 inches long at birth, and with the bright yellow collar characteristic of their species well shown. In order to facilitate egress from the egg-membrane, a temporary horny tooth is developed by means of which the membrane is ruptured, and, its purpose attained, this structure then disappears. The average number of eggs deposited by an adult female ring snake may be put at from twenty-five to thirty in a season.[1]

---

[1] Amphibia and Reptiles, p. 499.

In addition to the ring snake, the only other indigenous reptile which is an egg-layer is the rare South of England Sand Lizard, *Lacerta agilis.* This species is practically confined to Dorset, Hants, Surrey, and other counties south of the Thames. Very few authenticated specimens have been taken in counties north of this, though it is constantly recorded in mistake for the common lizard. In this species the egg-membrane is of much firmer consistence than is that of the ring snake, the white eggs having the appearance of stiff parchment and varying from five to eight, being extruded in May or June and hatched about the beginning of August. The young "are grey-brown above with white black-edged spots—the under parts are whitish."[2]

We may now turn our attention to the four British reptiles which are ovo-viviparous. The first half of September is the most usual date of birth of young adders, but again in this species, as in all the others, the influence of the particular season has to be allowed for. I expect that this year will prove a very late breeding season, and if the autumn is wet and cold it will go hard with the young adders. In an

[1] British Serpents, p. 21.

[2] Amphibia and Reptiles, Dr Gadow, p. 554.

ordinary summer, female adders may be seen in July and August sunning themselves on the edge of some cover into which they can readily retire, and hastening on the process of development by deriving as much warmth as possible from the heat of the sun. The males, which are busy amongst the young mice and other small mammals, are rarely seen at this time, keeping very much to the seclusion of the bracken or other vegetation of their locality. Hence it is that a summer collection of adders is found to consist mainly of females. These latter, heavy with young, are extremely sluggish in movement, and are hence easily captured, but are more savage now than at other seasons. In due time they bring forth a family of about twelve or thirteen,[1] and if an adder mother be killed by a blow from a stick just before parturition takes place, the young adders escape from the ruptured body alive, and the ignorant observer immediately concludes that they have been swallowed, and writes to the nearest paper to say that he saw the phenomenon.

Young adders at birth are from 6 to 8 inches in length, their poison fangs are fully developed and the poison-gland functional, but of course the dose of venom they are capable of injecting is small, and the effect on a human being is similar to that from a severe wasp sting. They have all the characteristic markings of their parents, but the colours are not so brilliant as they are after the first spring sloughing has taken place. Their infant diet is a matter of conjecture, but probably consists of insects, slugs, worms, and such small fry. Very soon, however, the young reptile is capable of swallowing small mice, which it prefers to anything else.

Anguis fragilis, the slow-worm, brings forth a family of from six to twelve young ones in August or September, the size at birth being rather under two inches in length, the thickness not much more than that of a wax vesta. No nest is made by the mother. The young burst the egg-membranes immediately as they are extruded, and in the course of twelve weeks or so the young reach a length of 3 to 4 inches. They feed at first on very small insects, spiders, and suchlike; later on slugs are the favourite diet.

---

[1] British Serpents, p. 145.

The colour at birth is a beautiful silvery white with three fine lines of black, one median and one on each side of the body, the ventral surface being black. I have never observed any indication of the existence of parental relationship between mother and offspring.

Lacerta vivipara, the common lizard, like the slow-worm, brings forth from six to twelve young, and likewise leaves her offspring to their own devices from the moment of birth. The young are less than one inch in length at birth, and do not feed for some days. They then devour small insects. The colour of the young is at first almost black.

Coronella austriaca, the rare smooth snake, brings forth usually not more than six young at a birth, though sometimes as many as twelve are born, the time of birth being at the end of August. I have never had the opportunity of observing the young of this species in a state of nature.

A good deal remains to be done before we know all about the early life of our indigenous reptiles, and I commend the subject to the attention of field naturalists during this breeding season, and shall be glad to hear the results of their observations.

Some Signs of Age and Sex in Fishes.

By F. G. Aflalo, F.Z.S., F.R.G.S.

When, early in the present year, Mr J. Stuart Thomson published in the Journal of the Marine Biological Association a very interesting and suggestive article on "The Periodic Growth of Scales in Gadidæ and Pleuronectidæ as an Index of Age," students awoke to the realisation that the outward indications of age in the class *Pisces* were somewhat vaguely demarcated. There can be little doubt that if Mr Thomson's theory proves to have any value—and there is at present no legitimate reason for doubting its soundness, though he has yet to pursue further researches—the growth of scales will form a reliable clue to the age of a fish belonging to groups other than the cod and plaice families, on which primarily he has based his doctrine. If eventually we are able to tell the approximate, or even exact, age of a fish by reading off the annual rings in its scales as viewed under a low-power microscope, just as, in somewhat different fashion, the ring marks betray the age of a tree, a very interesting addition will have been made to our practical natural history. Their growth, he thinks, is accelerated in the warm months and retarded in a corresponding degree in the cold, and we may interpret this irregular development at different periods of the year as a proof that abundance of nourishment and a high temperature are coincident beneficial conditions, lack of food likewise accompanying a fall in the thermometer.

Now, the outward signs of the age of fishes are far more vaguely understood than those which indicate their sex, and it will be the object of the present notes to give some idea of what we know of each outside of the more elaborate intimacy of the scientific laboratory.

The chief commonly accepted physical index of age in a fish is without doubt its size. There is no nice scale on which size and age are reckoned. Anglers somewhat loosely term a young pike a "jack," though on the Thames and some other waters the word "jack" is used indiscriminately of pike of any size. In the same way, the sea-fisherman calls his young bream either ballards or, at a still smaller stage, chad; and in Australia the small red bream becomes a "squire" when half grown and a schnapper in its largest stage.

Such inexact designations are, however, of little scientific value, and must be regarded as having their chief use in the fishing trade, where it is required to indicate fish of a "class,"[1] otherwise of a certain size.

Somewhat more satisfactory are the names applied in its various stages to the salmon, for they indicate the different journeyings of the fish in its strange division of life between salt and fresh water. Thus salmon "fry" grow to a length of perhaps 1¼ inch at two months, while the "parr" of between 3 and 4 inches is approximately six months old. The

---

[1] This commercial term must, of course, not be confused with the "class" of zoologists. Fishes are a class, as also birds or mammals.

"smolt" of 6 or 7 inches long may be two years old or thereabouts, and the "grilse," which is the salmon on its first return from the sea, will be some six months older. The age of full-grown older salmon is more difficult to determine, and we have to fall back on comparisons of size. Weight is in all cases deceptive, for so much depends on recent feeding and on general opportunities of nourishment.

Coming to the sex of fishes, we find somewhat more satisfactory evidence to go upon. Here, too, comparisons of size are not quite unimportant; for it is found that in teleosteans, or bony fishes, at any rate, the female is the larger for her age, though there are exceptions in plenty, such as, for instance, *Callionymus* and *Arnoglossus*. Size as an indication of sex is most apparent in the conger eel, for every individual measuring upwards of 2 feet 6 inches may safely be regarded as a female. The female conger also has a more pointed snout, while that of the male is blunt. Similar distinctions in the shape of the snout are noticeable in the fresh-water eel. The external sexual characters of fishes are, with the exception of the claspers in sharks and rays and the pouch in pipe-fishes, practically all of the "secondary" kind —that is to say, they have no connection with the function of reproduction. Size, colour, and seasonal developments in the fins are among the commonest secondary sexual characters in the fish world. The most striking case of difference in colouration of the two sexes is that of the dragonet (*Callionymus*), the brightly coloured male of which differs in so marked a degree from the duller female that they were long known by different names, the former being called the Gemmeous Dragonet, while his mate went by the title of Dusky Skulpin. This and some other fishes, such as the lumpsucker (the sexes of which are known in Scotland as the cock-paidle and hen-paidle), remind the naturalist of the sex differences in the plumage of birds, and indeed the difference between the male and female dragonet is not less than that between the black cock and grey hen or between the cock and hen pheasant. In fact, the sex distinctions in the dragonet do not end with mere colour, for the male has a larger head than the female, and he may further be recognised by the long filaments that develop in the dorsal fin. In the rays and skates there is a strong difference in the teeth of males and females, those of the former being sharper than those of the latter; and some of these rays are further said to display sexual differences in the number and arrangement of the spiny tubercles of the upper surface, but there seems to be some difference of opinion as to the precise value of such distinction.

On the whole, as will perhaps have been gathered from these brief remarks, our acquaintance with outward signs of age and sex in fishes is extremely limited, and it may be that, in one at anyrate of these directions, Mr Thomson's recent discovery will open up a wide field of research.

A Note on the Angler-Fish.

By Sir Wm. Turner, K.C.B.

The perusal of Mr Afialo's article on the Angler-fish (*Lophius piscatorius*) in No. 1 of the 'Field Naturalist's Quarterly' has recalled to my recollection the capture of a large specimen of this curious fish. About twenty-five years ago I was spending my autumn holiday in a house on the banks of Loch Goil, Argyleshire, and one morning word was brought to me of the capture, by the steward of the local steamer lying at the pier on the opposite side of the loch, of a very strange fish. I at once rowed across, and on applying to the steward heard from him how the fish, which was a fine specimen of *Lophius piscatorius*, was caught. When on deck in the early morning he heard some splashing in the water, and on looking over the side of the ship, the tide being low, he saw a fish with a big head amidst the seaweed. He seized the handle of a mop, such as sailors use to clean the deck, and pushed the mop towards the fish, which at once opened the cavernous mouth to receive it. The steward then lifted the fish on to the deck of the steamer, for the teeth in its jaws, owing to their recurved direction, became fixed in the mop, and the fish could not disengage itself. The specimen was unusually large, its long diameter being 4 feet 4 inches. I dissected the viscera and prepared the skeleton, which I have preserved in the Anatomical Museum of the University of Edinburgh.

Lophius piscatorius is characterised by having associated with it a special parasite, which is attached in considerable numbers to the gills and the branchial pouches. Attention was first directed to this parasite, so long ago as 1835, by Dr George Johnston of Berwick. It has subsequently been seen and described by other naturalists, and has been referred to the genus *Chondracanthus*, species *lophii*, a parasitic crustacean. I first saw this parasite in 1861, in a small specimen of *Lophius* captured at Whitby in Yorkshire, and in conjunction with Dr H. S. Wilson I gave an account of its structure in the Transactions of the Royal Society of Edinburgh of the following year. Large numbers of this parasite were also attached to the gills and branchial pouches of the Loch Goil *Lophius*.

Montagu's Harrier in North Wales.

By H. E. Forrest.

Montagu's Harrier obtains its trivial name from Colonel Montagu, who did so much for the ornithology of Britain eighty years ago. He it was who distinguished this from the closely-allied Hen Harrier, and bestowed on it the distinctive title *Circus cineraceus* (ash-coloured Harrier).

It is distinguished from the Hen Harrier by its more slender build and longer wings, which, when closed, reach to the end of the tail. The male is further distinguished by having a dark bar across the wings, which is not found in the other species. Mr Howard Saunders points out that either sex, at any age, may be distinguished from other members of the genus by the fifth primary *not* being emarginate on its outer web.

In both *C. cyaneus* and *cineraceus* the adult male is of a pale grey colour, though the female is brown. The young of both sexes are brown. At the time of writing I have just examined a young male Montagu's Harrier which was shot by a keeper on June 6 about six miles north of Shrewsbury (second record for Shropshire). Its plumage is in a transition state between youth and maturity, brown and grey feathers being intermingled all over the body, whilst the dark bar on the wing is not yet very distinct.

Several writers on ornithology state that Montagu's Harrier is more numerous than the Hen Harrier, whilst Rev. M. A. Mathew goes so far as to state that "there is hardly a county in England or Wales from which the nest has not been reported."[1] As regards the six counties of North Wales, I have for a considerable time been collecting particulars on the vertebrates from every available source. The records of Montagu's Harrier are extremely scanty, only four or five in all, and until lately I had no authentic record of its nesting in *North* Wales. The following particulars of an actual nest near Bala last year are therefore of special interest: they are here set forth in rather more orderly fashion than they reached me, since I only "came in at the death."

During May 1901 a pair of birds were seen from time to time by different persons frequenting the grouse moors around Bala. At first they were seen on the north side of the Berwyns, but afterwards to the south. They had long wings, and flew low down over the ground. From the description given it was thought that they were Harriers of some kind, but the first intimation of their actual species was the sight of the dead birds which were shown to me by a Shrewsbury taxidermist, Mr George Cooke, on 24th June 1901. They were an adult pair of Montagu's Harriers, the breast of the hen nearly bare and the plumage bearing other signs that she had been sitting for some time. The male measured 17½ in., wing 14½ in.; the female 18¼ in., wing 14¼ in. The larger bird had the shorter wing.

On inquiry it was found that the birds had been killed at the nest by a keeper ignorant of the rarity of the species, whilst the eggs had been taken to Colonel Burton of Bala, who kindly lent them to me to replace in the nest while photographing it. He still has the eggs; the birds are now in the collection of Sir H. B. Robertson at Palè.

---

[1] British Birds, vol. iii. p. 99.

In company with my friend Mr J. Steele Elliott I went over to Bala on 8th July, and visited the spot with the keepers who had found the nest and killed the birds. It was a fearfully hot day, and we found the three miles tramp through heather up to our waists very fatiguing: we had our reward, however, in obtaining several good photographs, one of which is here reproduced.

I learned from the keepers that for several weeks back they had seen the "hawks" flying to and fro over the moor, which is here about 1200 feet above sea level. At first they ranged over a considerable area, but afterwards restricted themselves to the vicinity of one long ridge. Then the brown (hen) bird ceased to be seen, though the blue (cock) bird was still in evidence, particularly in the mornings and evenings. He used to skim along over the ground for a mile or so, returning on a parallel line almost to the starting-point, repeating the manœuvre till he had in this way covered every portion of the space within these bounds. The great length of wings and tail was remarked by the keepers. Grouse are plentiful here, and the cocks, who are very aggressive in the breeding season, on the approach of the harrier would rush out with loud cries of warning or anger. The keepers took it into their heads that the harriers would molest the grouse, so determined to destroy them. They found that the hen came off the nest to feed just after sunrise, so one of them went up at night and concealed himself in the heather near where he suspected the nest to be. About 4 A.M. the hen returned from feeding and disappeared at a certain spot. After waiting some time and seeing no signs of her reappearance the man ran forward rapidly to the spot, and there, in the midst of the deep heather, was the nest! The poor bird rose almost at his feet and was shot. Thinking the widower would probably return, the keeper set a trap at the nest. His expectation was partially fulfilled; the bird did return but managed to avoid the trap, for when the nest was visited next day the eggs were found covered with pieces of dead rush! Whether the cock had sat on the eggs deponent sayeth not, but he had done his best to shield them. He was shot next day, but only winged, so was

Photo by T. Dewhurst.

STAG BEETLE ON LETTUCE.

Photo by H. E. Forrest.

NEST OF MONTAGU'S HARRIER.

Photo by T. Dewhurst.

MALE AND FEMALE BUFF ERMINE MOTHS.

Photo by T. Dewhurst.

LARVÆ OF S. LIGUSTRI ON PRIVET.

taken to Bala with the idea of keeping him alive, but as he seemed to be suffering it was thought best to put him out of pain.

The nest itself was a slight structure of dead rushes laid on the bare earth, well hidden amongst bilberry and heather quite three feet high, and extending for miles in every direction. There were a few feathers in it which had evidently dropped from the sitting bird. A quill feather is seen in the illustration. The four eggs were pale bluish white, entirely devoid of markings. They were very near hatching, and as the hen was shot on June 21st we may assume that the birds began to nest towards the end of May.

Montagu's Harrier is said to feed principally on small reptiles and large insects, though it also eats small birds and mammals. The stomachs of these contained feathers, apparently of the Meadow Pipit. It is much to be regretted that these came to such an untimely end through the ignorance of keepers, for, even from their own point of view, the birds are very harmless. I questioned the men on the point, and they admitted that they had never seen the harriers molest the grouse. Still, the birds being dead before any one knew of their existence, the best course seemed to be to collect and publish all available details concerning an event which may never occur again in North Wales. Hence this paper.

The Dates of Arrival of Our Summer Migrants.

By W. Percival Westell, M.B.O.U.

The following are the dates of arrival in various parts of the British Isles of most of our summer migrants in 1901, as collected by the writer. During the spring of that year I received over one thousand separate records giving dates of these first arrivals, and a few notes in regard thereto will, I venture to think, be of interest and use to students of British bird-life, and will serve for comparison in other seasons. It is unnecessary to set out the whole of the data received, and I shall content myself by giving the dates of arrival of each species recorded from each county, the earliest record in any one county sufficing for any subsequent dates recorded for other parts of the same county.

The blackcap usually reaches our shores from Northern Africa about the middle of April, and the earliest record on my list is April 10, the locality being Clevedon in Somerset. Between the 14th and 22nd of that month it was reported from—14th, Surrey; 16th, Cambridge; 17th, Sussex; 18th, Northampton and Oxford; 19th, Suffolk; 21st, Hants and Warwick; 22nd, Essex and Worcester; and the latest arrival sent to me was April 24, when the bird was first observed in Gloucester.

The chiff-chaff—that cheery little visitor from the shores of the Mediterranean—is one of the earliest harbingers of spring, and is rarely later than the first week in April; but the spring of 1901 being a backward one, this species seems to have been later in coming amongst us than usual. The only March record I have is the 30th, the favoured locality being Elveden in Suffolk. The next two dates were the 3rd and 5th April, when it appeared in Somerset and Sussex respectively. Between the last-mentioned date and the 21st April it was also reported from—6th, Warwick; 7th, Berks, Herts, Leicester, and Northampton; 8th, Hants and Surrey; 9th, Oxford; 11th, Norfolk; 12th, Worcester; 15th, Mid-Lothian; 16th, Cambridge, Essex, and Isle of Man; 17th, Stafford; the latest record being 24th April, from Montgomeryshire, North Wales.

It may perhaps be interesting to record in this particular paper the occurrence of the chiff-chaff as a resident bird in Cornwall. My friend Mr A. W. Hext Harvey regularly observes it at Penzance all through the winter, though he tells me that it is always quite silent at that season and does not commence to utter its two well-known notes until spring is approaching.

The corncrake, which generally arrives from Algeria, Egypt, Asia Minor, and Palestine during the last week in April, was first recorded from Stafford on April 21, the next appearance being the following day in Ayrshire and the Isle of Man! Between April 23 and 30 it was also reported from — 23rd, Flint (North Wales), Gloucester, Montgomery (North Wales), and Notts; 24th, Tyrone (Ireland); 27th, Denbigh and Yorkshire; 29th, Shropshire and Warwick; the latest arrivals being May 4, Cheshire and Mid-Lothian.

From the many hundreds of records sent me in regard to the cuckoo, it is evident that the general date of arrival was between the 18th and 22nd April. It usually arrives from Central Africa and Southern India—its winter quarters—about the middle of April. The 7th of that month is the earliest date on my list, when it occurred in Cumberland, Essex, and Kent. On the 8th the bird was recorded from Sussex, and in the following order elsewhere: 9th, Gloucester, Herts, and Yorkshire; 10th, Bedford, Hants, and Surrey; 11th, Leicester and Notts; 12th, Oxford; 13th, Devon; 15th, Somerset and Suffolk; 16th, Berks and Norfolk; 17th, Dorset, Lincoln, and Shropshire; 18th, Bucks, Isle of Wight, and Worcester; 19th, Cambridge, Derby, Isle of Man, Northampton, Pembroke, Rutland, Stafford, and Wilts; 20th, Cardigan, Hereford, Middlesex, and Warwick; 21st, Cornwall, Kerry (Ireland), and Montgomery (North Wales); 22nd, Ayrshire, Cheshire, and Glamorgan; 23rd, Yorkshire; 29th, Haddington (Scotland); and lastly, on May 4, in Mid-Lothian.

Only one solitary record of the appearance of the stone-curlew reached me, and that from Elveden, Suffolk, where it appeared on April 9. Its winter quarters are temperate Europe, Northern Africa, and South-Western Asia, and it generally arrives some time in April, though occasionally as early as March.

The turtle-dove winters in Northern Africa, Egypt, and Nubia, and may usually be looked for the latter part of April. Worcestershire holds the earliest record for 1901, the date being April 19, and between the 20th and the 29th of the month it was reported as follows: 20th, Somerset; 23rd, Essex, Kent, and Surrey; 24th, Berks; 27th, Oxford; 28th, Herts; 29th, Sussex; Warwick being the latest date sent in —namely, May 3.

The spotted flycatcher is apparently little known, four records only being included for this species. They were—April 25, Stafford; May 4, Ayrshire and Somerset; May 12, Sussex. This is one of our latest migrants, and does not generally arrive from Africa until between the 7th and 20th May.

The house-martin first appeared in Kent on April 14, and between the 16th and the 28th in other counties as under: 16th, Essex; 17th, Bucks; 19th, Mid-Lothian; 21st, Herts, Norfolk, Sussex, and Wilts; 22nd, Northampton; 24th, Suffolk; 25th, Oxford and Somerset; 28th, Ayrshire; the latest being May 2, Hants, and May 4, Surrey. This bird usually arrives from its winter home (south of Abyssinia) about April 20, *usually* a little later than the swallow.

Its relative, the sand-martin, generally makes its appearance before either the swallow or house-martin, and the records sent me bear out this statement, for on March 31 it was observed at Reading, Berks; and from April 1 to 23 as follows: 1st, Northampton and Yorkshire; 6th, Devon; 8th, Dorset, Hants, Shropshire, and Sussex; 13th, Essex; 15th, Surrey and Warwick; 17th, Cambridge and Norfolk; 18th, Somerset; 19th, Bedford; 23rd, Tyrone (Ireland); 25th, Ayrshire. May 6, Worcester, was the latest date sent in. Its winter quarters are India and Africa.

The nightingale generally arrives from Africa about the middle of April. On April 5 it was reported from Essex and Kent, and from the 8th to the 21st of that month in the following order: 8th, Norfolk and Sussex; 9th, Somerset and Surrey; 11th, Herts and Warwick; 12th, Hants; 14th, Berks and Wilts; 16th, Middlesex, Northampton, and Suffolk; 18th, Bucks, Gloucester, and Lincoln; 19th, London (near the Horse Guards) and Oxford; 20th, Cambridge, Notts, and Worcester; 21st, Isle of Wight, Leicester, and Rutland.

The nightjar is apparently little known, hence four records only reached me, thus: April 23, Somerset; 26th, Hants; 30th, Surrey; May 11, Berks. India and Africa is the winter home of this useful bird, and it usually arrives from the first week of May onwards.

The ring-ousel is an early visitor, and arrives in March or beginning of April from Northern and Central Africa and

Asia Minor. The only record forwarded was March 17, from Lewes, Sussex.

The tree-pipit sojourns during the winter in Africa, Persia, and India, and may be looked for about the middle of April. April 9 was the earliest date recorded, the favoured spot being Upper Tooting, Surrey, and the following up to the 29th of that month: 11th, Sussex; 14th, Herts; 15th, Leicester; 19th, Warwick; 22nd, Montgomery (North Wales); 23rd, Hants; 25th, Somerset and Tyrone (Ireland); and 29th, Oxford.

The redstart usually arrives from its winter quarters in Northern Africa from the commencement to middle of April. April 9 is the earliest date on my list for the year under review, when the bird was observed at Upper Tooting, Surrey, and subsequently between the 12th and 28th as under: 12th, Middlesex and Sussex; 16th, Northampton; 18th, Hants, Oxford, and Worcester; 19th, Warwick; 20th, Somerset; 21st, Berks; 22nd, Wilts; 23rd, Essex; 25th, Stafford. May 11, Ayrshire, was the latest date sent in.

Four records only of the common sandpiper reached me, as under: April 15, Ayrshire, Northampton, and Shropshire; 16th, Sussex. It generally occurs about the middle of April, when it arrives from Africa.

The red-backed shrike is usually a somewhat late visitor, reaching our shores from Africa towards the end of April or early in May. The only two records sent me were—May 8, Worcester; May 12, Somerset.

The swallow arrives towards the middle of April, but my correspondents recorded its appearance during the spring of 1901 as under: March 31, Hants; and between April 2 and 24 in following order: 2nd, Devon, Dorset, and Worcester; 4th, Oxford; 6th, Gloucester; 7th, Herts and Wilts; 8th, Berks, Essex, Kent, Middlesex, Northampton, Somerset, Sussex, and Warwick; 9th, Carnarvon and Dublin; 10th, Yorkshire; 13th, Isle of Wight; 14th, Cambridge and Stafford; 15th, Surrey; 16th, Norfolk and Shropshire; 18th, Bedford, Cardigan, Cornwall, Derby, Hereford, Leicester, and Rutland; 19th, Ayrshire and Lincoln; 20th, Bucks, Cheshire, Isle of Man, London, and Pembroke; 21st, Notts and Suffolk; 22nd, Flint (North Wales);

23rd, Cumberland; 24th, Mid-Lothian. The swallow winters in Ethiopia and India.

The swift is one of our latest summer migrants and one of the earliest to depart. It generally reaches us from Africa early in May, but between April 19 and 25 it was reported to me as having occurred thus: 19th, Worcester; 21st, Dublin and Hants; 22nd, Sussex; 24th, Suffolk; 25th, Somerset; whilst between May 1 and 5 it reached—1st, Gloucester; 4th, Surrey; 5th, Ayrshire and Stafford.

The yellow wagtail may generally be looked for towards the end of March or early in April. The earliest record I have is March 20, when it appeared as far north as the Pentland Hills, in Mid-Lothian. The only remaining dates sent in were—April 15, Ayrshire; 17th, Berks, Sussex, and Worcester; 21st, Warwick. This species also winters in Africa.

The garden-warbler generally arrives from Africa the end of April or early in May. On April 23 it was recorded from Northampton and Sussex, and on 24th and 30th from Gloucester and Warwick respectively. It did not reach Scotland (Ayrshire) until May 19.

The grasshopper-warbler was reported from Somerset on April 19; 22nd, Sussex; 29th, Surrey; May 1, Warwick; May 14, Ayrshire. Northern Africa and Southern Europe is its winter habitat, and it generally arrives about the middle of April.

The reed-warbler arrives towards end of April or early in May from Africa. The only records sent me were from Norfolk, where the bird appeared at Warham on April 30, and Lewes, Sussex, on May 2.

The sedge-warbler usually arrives from Northern Africa and Asia Minor the latter part of April, but earlier records than this were sent me as under: April 9, Oxford; 14th Berks; 19th, Sussex; 20th, Northampton; 28th, Ayrshire; 30th, Norfolk and Warwick; May 5 and 6, Surrey and Worcester respectively.

The willow-warbler passes the winter in Africa and Persia, and the second week in April generally sees it amongst us. As early, however, as March 6 the bird was authentically reported from Crowthorne, in Berks. The arrivals after this were—April 7, Somerset; 8th, Hants, Surrey, and Sussex; 9th, Gloucester; 10th, Northampton and Stafford; 11th, Norfolk; 14th, Herts and Worcester; 15th, Warwick; 18th, Ayrshire; 19th, Cambridge; 21st, Montgomery (North Wales); 24th, Mid-Lothian; 30th, Tyrone (Ireland).

The rarer wood-warbler usually visits us the end of April or early in May, its winter quarters being the same as the last named. I identified it in Herts on April 14, and subsequent records were—April 22, Berks; 25th, Oxford and Somerset; 30th, Tyrone (Ireland); May 1, Ayrshire.

The wheatear may generally be expected from its winter home (Western and Northern Africa to Persia and Northern India) the end of March. On March 17 it was seen in Sussex for the first time; 26th, Hants; 31st, Somerset. Other records were—April 2, Stafford; 3rd, Herts and Wilts; 4th, Oxford and Suffolk; 5th, Cheshire; 6th, Ayrshire; 9th, Surrey; 13th, Mid-Lothian; 16th, Gloucester and Tyrone (Ireland).

The whinchat reaches us, as a rule, from Northern Africa from the middle to end of April. The 1901 appearances sent in to me were—April 20, Surrey; 21st, Worcester; 23rd, Northampton, Sussex, and Warwick; 26th, Ayrshire; 27th, Mid-Lothian.

The greater whitethroat generally arrives from Southern Africa somewhere about the first fortnight in April. On April 8 it appeared in Sussex, the remaining records being—14th, Shropshire; 22nd Hants, Montgomery (North Wales), Somerset, and Worcester; 23rd, Essex and Kent; 24th, Oxford; 27th, Herts; May 4, Ayrshire.

The lesser whitethroat winters in Africa, and arrives about the same time as its last-mentioned relation. It appeared in Somerset on April 10; 21st, Worcester; 22nd, Surrey and Sussex; 23rd, Kent.

The last bird on my list, the wryneck, spends the winter in China and Northern Africa, and arrives about the first or second week in April. The earliest records I have for the year under review are—April 1, Essex and Herts; and subsequently as follows: 5th, Kent; 7th, Sussex; 10th, Somerset; 12th, Hants; 14th, Berks; 16th, Gloucester; 17th, Devon and Surrey; 22nd, Norfolk; 26th, Worcester.

Of the thirty-six regular summer migrants to the British Isles (and which regularly nest in this country) records are set out above of no less than thirty species, those unrecorded being the spotted crake, hobby falcon, pied flycatcher, Kentish plover, quail, and marsh-warbler, all of which, although regular summer migrants, are very sparsely distributed.

Lives Measured by Minutes.

By the Rev. John Isabell, F.E.S.

In the days when the Psalmist wrote, the life of man was estimated at threescore years and ten, with another ten years added in exceptional cases. That men sometimes reach a hundred years is undoubted, but nevertheless a person who has seen eighty summers is invariably regarded as old. Animals vary greatly in the length of their lives. Elephants, eagles, and parrots may celebrate their hundredth birthday, but our domesticated beasts are thought to be aged when they have reached a quarter of a hundred. A horse is old at twenty, a donkey at twenty-five, and a cat or dog at fifteen. The span of existence allotted to insects is shorter still; the fly and butterfly commonly enjoying but one summer of vigorous life, and then being taken off by the cold, if they are not previously snapped up by a bird. Water-beetles under favourable circumstances may live for five years, and the social bees and ants are known to live longer than their solitary relations.

But when we measure the life of an insect we usually take into consideration only a part of that life—namely, that spent in a mature state—forgetting or ignoring the time passed as a grub. Thus the *cicada*, famous for its voice, and for the sly remark of a Greek poet that it was fortunate in having a dumb wife, has in America some noteworthy relatives, which pass seventeen years underground before they come to the surface and give the world the benefit of their music. Judged by their winged life, they are poor subjects for an insurance office, whereas in reality their lives are longer than those of any other known insect. May-flies have been taken by the poets as the type of the brevity of life, and the name Ephemera has been conferred upon them. This is justified by the fact that their mature existence lasts in some species for only an hour, or even less; the insects emerging from the water on a summer's evening, soaring aloft, depositing their eggs, and dying, almost like a flash of light. But as the fruit of autumn is the crown of all the preceding months, so the activity of may-flies is only the culmination of their career, for it has been preceded by a two years' existence as a grub in the water.

There are at least 300 species known to science, about 40 of which are found in Britain. They are related to the dragon-flies, and possess four wings covered by innumerable veins, the hinder pair being much smaller than those in front, in contrast to those of their fierce cousins, whose wings are almost equal in size. As may-flies do not take food when mature, their mouths are practically useless; but what they lack in taste they make up in sight, the males of some species having no fewer than seven eyes—two in the ordinary position, three on the forehead, and two standing up as pillars behind them. Although they are exceedingly fragile, may-flies have left their signature on the solid rocks, their fossil remains found in very ancient strata showing that they existed in abundance in the far-off days when the coal which we are now burning flourished as living plants.

But begin at the beginning — namely, with the eggs. Naturally enough there is some diversity in the method of depositing these. Some species exercise care, and apparently attach them to stones and weeds under water; but the majority simply drop them overboard in two compact masses embedded in jelly, each mass containing about 350 eggs. The covering quickly dissolves on contact with the water, and the eggs, instead of remaining in a heap, are sown broadcast over the bottom of the quiet river or pond selected to be their future home. Many eggs have curious appendages, which serve as hooks to keep them from floating down the stream.

There is a great diversity in the time required in the hatching of the eggs of different species, some breaking the shells in seven days, and others (it is said) appearing after as many months. There is also a great difference in the structure and habits of the larvæ when hatched; although all have this in common, that they cannot live out of water. There are, first, the burrowers, with long bodies, small heads, and forelegs adapted for digging. These live in slow streams, tunnel the clay or earth of the banks, and eat minute animal substances contained in the soil in which they dwell. Then come a set with flattened bodies, found in clear, strong streams. They cling to the stones with their very broad legs, and feed on the small water-insects which come within their reach. A third section live in ditches and pools, and having no fear of being swept away by the current, use their excellent tail fins to propel them through the water in pursuit of the small creatures on which they feed. Lastly, we have a group which are content with creeping on the bottom of streams; compensating for their lack of swiftness by using a covering of mud as a disguise while hunting their prey.

The breathing apparatus of the larvæ (which has to be entirely remodelled when they sail off into the air) is of a very efficient nature, one species having such excellent gills that they are said to be superior to those of any other aquatic insect. While in the water the young may-flies increase in size by a series of moults, to the number of twenty or more, so that the same skin does not serve them long. As they grow faster in summer than in winter, they then change their costume oftener. The burrowing group have a curious habit of making two doors to their houses at a little distance from each other, so that if a disagreeable visitor appears at one door the owner is able to depart by the other.

If the lives of may-flies ended at the expiration of a couple of years spent in the water, little would be heard of their history; but the extraordinary swarms which emerge in summer, engage in elegant dances in the air, and die before the rising of another sun, have attracted attention to them. I remember alighting at a railway station in Switzerland, near a small river, and finding the platform covered with may-flies, while others were fluttering and falling like snowflakes. Their exit from the water is one of the strangest things in nature. They reach the surface, the skin cracks, the winged insects drag themselves out and fly away, all within the space of ten seconds. No such rapid transformation is known elsewhere. That may-flies are eminently fitted for the battle of life is shown by the prodigious number sent forth yearly, some of the swarms consisting of many millions. It is said that in certain species there are as many as five thousand males to a single female.

The dances of may-flies have been celebrated by prose writers and by poets. D'Albertis, who saw vast swarms in New Guinea, says that "for miles the surface of the river, from side to side, was white with them as they hung over it with gauzy wings; at other moments, obeying some mysterious signal, they would rise in the air, and then sink down anew like a fall of snow." It has been suggested that the peculiar eyes of may-flies have been specially conferred for the enjoyment of these aërial evolutions. One species found in Ceylon is a flying lantern, the whole of its body being luminous. Another displays a faint blue light after sunset.

The Gulls of Twigmore Warren.

By A. E. Johnson.

The gregarious instinct of most sea-birds during the breeding season, and the unfailing regularity with which they return, year after year, to certain favoured spots for matrimonial purposes, is a matter of common knowledge. As a rule, these familiar haunts are situated, as one would naturally expect, in close proximity to the ocean,—either upon some sea-girt islet or rock, or upon the face of a precipitous cliff. A special interest, therefore, attaches to the habit peculiar to certain species of marine fowl of repairing to various *inland* retreats during the breeding season.

A remarkable instance of this peculiarity is to be found in the popularity which Twigmore Warren, in the north of Lincolnshire, has enjoyed from time immemorial as a breeding-place of the Black-headed Gull (*Larus ridibundus*). The "gull-ponds" of Twigmore are situated on the estate of Mr R. N. Sutton-Nelthorpe, of Scawby Hall, Lincolnshire. Scawby lies—roughly speaking—about midway on the Great Central Railway line from Retford to Grimsby, and about twenty miles south of the Humber, being thus within easy reach—from a gull's point of view—of the sea, although quite inland. Hither the gulls begin to come towards the end of March, and within a month vast numbers have assembled. The first eggs make their appearance at the latter end of April, but the best time to visit the ponds is later, in May, when the birds are nearly all sitting, and the margins of the pools are literally covered with eggs. As the month of June wears on, the colony is gradually thinned out by daily departures, until by the end of July not a gull is to be seen.

Apart from what may be called their great technical interest to the ornithologist, the Twigmore Gull-Ponds have many attractions to all lovers of nature. There are two sheets of water, the larger of which is rather a small lake than a mere pond, charmingly situated in a hollow, well wooded with pines and other trees, and bright—at the proper season—with the gay blossoms of many rhododendron bushes. And an extraordinary spectacle, easier imagined than described, the ponds present during the breeding season. Dotted thick upon the surface of the water, whitening the reeds of the margins and the banks in their thousands, and darkening the sky in dense flight, are countless myriads of snowy gulls, wearing the matrimonial livery of the dark plumage on the head which the species assumes during the spring, and from which it takes its popular name. The air is filled with ceaseless raucous cries, which sound on the outskirts of the encircling thicket like nothing so much as the roar of a racecourse when the numbers go up. And in the fields, for some distance around, numerous groups of birds may be seen hopping solemnly in the wake of the plough, eagerly pecking at the uncon-

Photos by A. E. Johnson.

THE GULLS OF TWIGMORE WARREN.

sidered trifles in the shape of worms, grubs, and insects which the ruthless share turns up.

For some time after the arrival of the first-comers the birds are somewhat shy, taking flight at the near approach of strangers to the ponds, more especially when the intruder comes in questionable shape through the trees, instead of advancing in full view across the open. This timidity, however, soon wears off, and the birds, particularly when sitting, exhibit a tameness quite astonishing. Even should they take flight when approached too nearly, it is only necessary to sit down and wait quietly for their speedy return.

So crowded are the ponds that the nests of the different birds—"pitches" would almost be a better word, since the eggs are laid on the bare bed of reeds—are so close together as to occupy, it might be said, every available inch of space. Indeed so great is the demand for accommodation that, according to Mr Sutton-Nelthorpe, who was kind enough himself to escort the present writer round the gull-ponds, it is by no means unusual to find of a morning a row of eggs stretched along the narrow plank which serves at one spot as a foot-bridge, laid by some luckless late arrivals in this comfortless fashion, for want of room elsewhere.

The eggs themselves display a remarkable variety in colouring and markings, which is excellently illustrated by a well-selected collection of specimens, taken from the ponds, at Scawby Hall: the series ranging from examples of the ordinary dark mottled eggs to others of a plain and self-coloured appearance. These latter, according to the keepers, are generally immature or unfertile eggs.

Near neighbour to the gulls of Twigmore, and in fact originally an off-shoot of that stock, is the colony of birds located on Black Rabbit Warren, Scunthorpe, about eight miles away, on the estate of Sir Berkeley Sheffield. Two-and-thirty years ago, it appears, when perhaps the Twigmore ponds were even more crowded than at present, a few adventurous birds, seeking fresh fields and pastures new, happened upon the three or four ponds at Scunthorpe which have since obtained the name of Blackhead Ponds. Here they decided to establish themselves, and five eggs, in the memory of a local and ancient inhabitant, were laid in the first year of their tenancy. To-day, the ponds, though not nearly so densely crowded as those at Twigmore, which are more secluded, and doubtless for that reason more popular, are frequented by a very numerous tribe of gulls, which increases in numbers every year. It will be interesting to see how long it may be before yet another colony has to be founded elsewhere.

Those readers who may chance to find themselves in the north of Lincolnshire and within reach of Scawby or Scunthorpe (which possesses a station on the Great Central loop-line from Doncaster to Grimsby) would do well to seize the opportunity of paying a visit to the Twigmore and Blackhead Ponds, though the former are by far the more worthy of a visit. Both places, as has been noted, are situated upon private property; but permission to visit either can no doubt be obtained if properly applied for.

Scunthorpe, it may be added here, is remarkable for two curiosities in natural history. On Black Rabbit Warren, where the Blackhead Ponds lie, is a breed—though not a numerous one—of black rabbits; while at Crosby, an adjoining hamlet, there existed not many years ago a warren of silver-haired rabbits much esteemed for their skins, but latterly exterminated owing to the former protection which they enjoyed having been removed, through the depreciation of the value of the skins consequent upon some vagary of fashion.

At Ashby, a couple of miles distant, are the remains of one of the most profitable of the old Lincolnshire duck-decoys.

Entomology in Summer.

By Claude Morley, F.E.S., &c.

It is a trite saying that the entomologist, no less than the poet, is born and not made: enthusiasm is a fine thing, goading us to perform prodigies while it lasts, but too evanescent to be of real service to the naturalist, who, to be thorough, must have at least three attributes abnormally developed. There are two distinct classes of naturalists: those who gather material and observe natural phenomena in their wild condition, and those who classify, examine, and perpetuate records in the study. Neither is of lasting value without the other; the collector — the "mere" collector he has often been unjustly termed—would work to little purpose were his captures to lie perdu, unnamed, in a chaotic mass in his cabinets and upon his shelves, while the student would have nothing to study unless it were brought in by the collector. In both these classes, of which few men possess sufficient leisure to become members at once, close and trained observation is of paramount importance: the former must not assume, because he sees a *Chrysis* emerge from a boring in a post, that this beautiful insect has drilled the hole or constructed the nest at the end of it; nor is the latter entitled to lay down the law, because a beetle possesses a stridulating file on its elytra or upon its abdomen, that it emits sound therefrom, unless his brother of the field has tested his theory upon the living insect. Thus observation without accuracy is nothing worth. But the surest evidence of the naturalist is his patience and steadfastness. I have infused a dozen men with enthusiasm in entomology; they have worked like Trojans for a time, a few months or even a year, but gradually the patience died, new interests grew up, and ere long they forsook the net and pin for pastures new.

At no time will this steadfastness be more trying to maintain than in the lengthened days of mature summer. You have collected assiduously all the spring, perhaps from the moss and bark days of late winter; you have taken an apparently countless variety of insect-forms, and you begin to wonder how many more there *can* be and to feel "love's sad satiety." Moreover, it will be found that there are not so many insects abroad as was the case in spring, and that a large number of those now met with have already been taken earlier in the year. In July a great many species are passing through the larval condition, and in August comparatively few beetles put in an appearance; where in June they fell in showers to the magic touch of the beating-stick, small result repays hard work in summer. You will perhaps feel as Mr E. A. Elliott, F.E.S., once wrote to me plaintively in August :—

"I wander about from the wood to the brook, and sweep through the meadows fair,
But wherever I go, to my sorrow it seems there is never a beetle there:
Whenever I come to a hedge or a tree, I quickly make ready a box,
But, though my umbrella invitingly yawns, not a bugling responds to my knocks!"

Nevertheless this state of things has its advantages: when one can go out into the byeways and hedges and force them to come in, one hardly notices the cracks and crannies they creep out from; but when you have to metaphorically go into the crannies and drag them out, you much more carefully note their pabulum and mode of living. When you have got all the "common objects of the country"—and you will be a very old man!—you yet, even in Britain, have the mountains and the moors, the broads and the fens, to explore; in each of these you will find a new fauna. In a lesser degree, in July especial attention must be paid to the flowering-plants and to the water-weeds. The great white tables of the Heracleum are usually quick with life, the thistles bear their drowsy bees, while later on Angelica is even more attractive to the insect hoards, who lick the honey from the tiny stylopods with keen avidity.

Last August I found myself in a locality totally unknown to me, and, with the aid of an ordnance map, discovered a truly ideal spot for hunting the elusive flyer. Through a narrow valley ran a little stream, whose margins were fringed with rough grasses, sedges, and marsh thistles; outside which was a thicket of alders, sallows, and guelder-rose, such as would be termed a "carr" in Norfolk. Beyond the alders was long, rank grass, dotted more or less thickly with bog-myrtle. This open space, sometimes so marshy as to constitute a real danger to the vicinity, was bounded on the left by arid, purple heath, and on the right the pine woods stretched away for several miles; while just where fir-trees overlapped the bog were sunny banks, whence sand was sometimes carted. But what was best about this fairy, tractless dell, where few men come, were widespread beds of tall Angelica, whitely gleaming from out the rough green grasses.

Here I was wont to come and pass the day, beating the trees for beetles, sitting long hours by the sandy banks to stay the too hurried flight of the nesting bees, but mostly strolling, pipe in mouth, among the aromatic umbels, which were crowded with flies and bees and butterflies, and even beetles too. Every now and then I caught the glint of a Musk-beetle, stretched full length and covering nearly all the table; and on one sultry afternoon I saw four flying high above the flowers, with legs and horns streaming behind them, like a duck's quaint legs. They were, however, out of reach, so I plaintively questioned "'Romia, 'Romia, where for art thou, 'Romia?" Anon, a brilliant Rose-beetle was sipping nectar, and, farther yet, a fine red and white and black Ichneumon, or a great green grasshopper, waved its horns in warning to all who would "molest her ancient, solitary reign."

And so the day wore on, till dusk descended as it only can in England, gently, unconsciously; gradually the sun sank redly below the fragrant heather, shedding a last warm glow upon the pine-tops; the shadows blackened among the alder-stumps; the redness melted into gold, until I found the moon already high and shard-borne beetles booming down the silent vale. Turning, with mingled feelings, I struck across the heath

> "Where the rooks stream home in a golden sky;
> And the world complains that a day should die!"

Bird-Life on the Broads: Summer.

By Rev. M. C. H. Bird, M.A., M.B.O.U.

A TYPICAL midsummer day on the Broads presents, to the casual observer, no such medley of bird-life as one cannot help noticing hereabouts in the springtime, before vegetation has sufficiently advanced to conceal our feathered visitors and the families which they have now to protect and provide for. It is wonderful what an amount of foresight birds exercise in the selection of a nesting-place, and this is particularly noticeable in the case of ground-builders which lay many eggs, such as Pheasants and Partridges, but the remark applies more or less to every species; and unless one is very careful to mark exactly the spot where the nest of Wild Duck or Water-Rail, Woodcock Owl or Willow Wren is, when the first egg is laid, by the time that the parent bird is sitting hard, and so loath to leave her eggs and betray their whereabouts, the rediscovery of them by the former finder is rendered very difficult by the intermediate growth of the surrounding vegetation.

I have notes of two Pheasants' nests made between double rows of garden peas: in both cases the eggs were fairly conspicuous when first laid, but as the pea haulms advanced to clothe their artificial supports, the selection of the nesting-site for protective purposes was amply justified. The Warblers, too, find the same concealment from the rapid growth of nettles, grass, reed, and climbing plants around their cradles, and tree-building birds are also assisted in the protection of their young by the denseness of the foliage in leafy June. A young Rook, which might perhaps have been wood-bound from the rifle bullet a few days previously, is now as leaf-bound from the sportsman's eye below as the young Wood-pigeon would be from the Peregrine's vision from above—were there any Peregrines left here to molest them. Carelessness and trustfulness, which are apparent traits in spring bird-life, have now passed away, and the knowledge of natural concealment at hand is rapidly taken advantage of. Small birds when disturbed now do not fly far away and view the intruder from a tall and distant twig or pointed last year's reed stem, but lose themselves in the labyrinth of adjacent greenery, and creep mouselike through the foliage if farther followed. So crepuscular are the habits of the Grasshopper Warbler in particular, that if once flushed and marked down no amount of brushing or quiet search will induce it to rise again above the sedge or grass tops. And the way in which the Whitethroat will throw himself shuttlecock-like over a hedge, tail uppermost, as he turns in to hide on the farther side, is most distinctive of the species. I read the other day a few lines on "Birds which never sleep," and although I did not find *Larus ridibundus* included in the list, I was thereby reminded of a night I once spent in an open boat on Somerton Broad, when a small and newly-founded colony of the Black-headed Gull made such a continual screeching throughout the hours of perpetual twilight, that what with the lapping of the water on the bottom of the boat, with only the bare boards and our boots wrapped up in our coats for pillows between it and our ears, and the incessant chatter of the Gulls above and around us, sleep was quite out of the question. But the Gulls seemed to be able to manage without rest at night, although busy enough all day in providing food for their as yet unflyable young, which were now dancing about like puffballs on the wavelets much farther from shore than they had ventured in the daytime. Their black and buff marbled plumage in the down renders them far less conspicuous than would be the case if clothed in parental white from infancy. In fact, in this attire, both when in the nest and whilst hunting for insects amidst the dark bases of old reed and sedge stems, they are as protectively coloured as the shells from which they were hatched, although the infinite variety in the ground colour of the eggs of this species leads us to wonder whether nature is working amongst them by slow but sure degrees to accommodate their tint to fresh surroundings, should these graceful and beneficial birds once have built in more lofty and inaccessible situations. 'Tis a pretty sight to see, and I delight to hear, a hundred Scoulton Cobs (their local name) following the plough and picking up the wireworms at barley sowing-time; but when one ventures into close proximity with such a number of these birds at eventide a few weeks later, their discordant cries are not conducive to slumber. Time and circumstances make a great difference to country sights and sounds. The hay-cutter, now in full swing, accompanied by some dozen Swallows and an odd House-Martin or two—for these latter are woefully scarce this season—sings not the mournful tale of bare fallows and dull autumn days shortly to follow, as will the American Self-Binder clicking in the August cornfields. The lazy humming of the Bumble Bee now spoiling our fuchsia-blooms irritates our nerves, whereas three months ago we gladly welcomed its unwieldy presence, hanging heavily from a precocious gooseberry bloom, as helping to foretell the coming spring. The aimless zigzagging of the House-flies in our study, as we pause in writing, causes no such pleasure as that with which we watched the equally inexplicable dance of the winter gnats on the south side of a fence last Christmas-time. We liked to hear the weird note of the lone Curlew as he floated far up in the clouds over our boat yesterday, but we certainly blessed him not last October when his warning cry revealed our presence to a bunch of Teal which we had been carefully stalking, crawling to them and wetting knees and chests in doing so in vain!

It is rather a mystery why more Common Teal do not breed in the Broad districts. They used to form the principal take in the Winterton Decoy; and there are special Teal ponds at East Somerton where I have seen some three hundred of these dainty little ducks congregated together, and once, had it not been for the reed-screens between us, I was within touching distance of several. In those days—the early 'Seventies—many more pairs reared their young in Broadland, and it was no uncommon thing to find their nests when we were hunting for Pheasants' eggs on the marsh walls—this was of course before the days of game farms and general egg-dealing. But now they, as well as the Garganey or Summer Teal, are on the decrease, and this seems to be the case throughout the eastern counties; although why the Shovellers, on the other hand, should have shown a revived interest in our neighbourhood as a breeding-station seems curious, unless it be that they are of a more venturesome and confiding nature than the Teal, to which idea the fact of their young occasionally coming to feed with tame ducks seems to lend colour. But then, why should they have deserted us in springtime to such an extent as they certainly did some fifteen or twenty years ago? The Coots, which in winter found safety in numbers and congregated together in the middle of the open Broad, are now scattered round the edges thereof in pairs, and shun the day in the reedy recesses where they may now and then be heard splouncing and splashing in their fights as one couple invade the territories of another. Like those of the Great Crested Grebe, their young are more gaily clad and are more musical in their voice than their parents, who now have, after many many generations, assumed a more sober plumage—if we may rely on the rule that early youth betrays the ancestral type. Young Robins of both sexes, and the few Gannets which visit the Broads in summer, and especially frequent the channel posts on Hickling, are well known but striking examples of the dissimilarity of plumage in adult and immature birds. This is a very paradise for Cuckoos; they choose Meadow Pipits for their earliest foster-mothers, and consign their latest eggs to the Reed Warbler, the Pied Wagtail acting as an intermediary. Never do I remember hearing the Cuckoos singing so late and so clearly as this season, and they have been very abundant too this year. A week or two ago I saw (July 10th) seven freshly-blown eggs, by their size, colour, and markings the efforts of two birds, I should say, as they were all taken within a mile radius.

Hairy caterpillars — of the Tiger, Eggar, and Drinker Moths — abound here, as their respective favourite food-plants flourish; and the Emperor Moth condescends to nibble our luxuriant willows and bogbeans, heather being scarce in the district.

The Common Bunting, locally called Bunt Lark or Thick-headed Lark, is another bird that for some unknown reason seems to be much more scarce than was the case on the marshes and arable land adjoining, whilst the Missel-thrush has greatly increased in numbers during the past fifteen or twenty years. It is curious how conspicuously and low down this wild bird sometimes builds its nest: last springtime I had one in a Scotch fir-tree within six feet of the centre of my drive and less than four feet from the ground, and so attractively adorned with a piece of white paper that for mercy' sake I abstracted the flag, lest my Sunday-school children might be tempted to violate the badge of truce. Flocking and resorting to the fields and marshes soon after the young can fly, these birds do no damage to garden fruit; but Blackbirds and Thrushes are an annual plague, and the quantities of young Robins demolish the currants ere the latter begin to colour.

An unusual occurrence was chronicled in the local press in the spring of 1901: in one of Mr Teasel's boatsheds on Stalham Staithe seven Thrushes' nests were discovered. On a mast lying across the beams of the shed, between the spars, the nests were placed side by side. Three nests were completed, two were partially lined, and two only partially built. Five eggs were laid in one nest, these being taken by a boy; two more were subsequently deposited—only one pair of birds were noticed. I recorded a somewhat similar instance in 'Land and Water' in 1880. The year before that there were two Blackbirds' and two Thrushes' nests built between the staves of a ladder which was hung up horizontally between the projecting reed roof at the back of some outhouses at Winterton Rectory. Year by year this strange nesting-site was used, and I have counted as many as seven nests between its staves during former Easter holidays; but only in 1879, I believe, was the state of incubation reached, when one Blackbird and one Thrush began to sit before the nests were destroyed. There were one or two facts which made against the ladder being turned into a successful nursery: in the first place, the back of the shed faces the high road at a distance of less than ten yards; and secondly, nidification took place just at a time when the ladder was required for attending to the wall fruit-trees. My idea is that there was only one pair of Blackbirds and Thrushes in either case, and the position between each rafter in the one instance, and each stave in the other, was so exactly alike, that they from time to time forgot the site they had selected—got mixed up, in fact, between the staves and rafters!

On dull and cold summer days all the Swifts in the neighbourhood seem to assemble together over the larger Broads, not only for their evening flight but also to feed by day: at such times the chill and heavy atmosphere probably brings down to earth their ordinary fare, thus compelling them to imitate their smaller relatives of the Swallow tribe in levying tribute upon aquatic insects. Under all climatic conditions Sand-martins, Swallows, and House-martins much frequent the Broads from their spring arrival to their autumnal departure. Here the earliest and latest migrant is most likely to be seen. Countless thousands of these three species mixed, roost upon the reeds from August onwards, but Swifts only appear over the water in any noticeable numbers during coarse weather. Twice only have I witnessed an aërial avian collision. In the last week of August 1877, being the proud possessor of a brand new breechloader, I was carrying it along the road between Winterton and Somerton to show to a friend and plate it against his own pet weapon. Several Swifts flying low down overhead attracted my attention. I thought of shooting one, as I had never examined the species in the flesh, and inserted a cartridge to satisfy my requirement. Scarcely had I closed the gun when a curious coincidence happened: two of the birds "charged" in the air—perhaps from striking at the same insect from opposite directions; or was it a muddle made by parent and offspring in attempting transference of food. However, one bird fell within twenty yards of me, over the roadside hedge, into a field of standing second-crop clover. During the few minutes whilst I was searching for it I feared my eyes had deceived me, but at last I found it, a young bird, not only stunned but quite dead. In the following September a covey of English Partridges rose wild out of some late-sown white turnips in front of my brother and myself: they were a long way off, but he killed one bird; two others collided, one of which we gathered in a dying condition.

The foregoing Swift story is capped by a tale, related in 'Facts for the Curious,' of a Snipe falling dead from concussion of the brain at the moment when some Cambridge undergrads pointed their walking-sticks at him as he rose, on the Granchester Meadows, I think.

Some few years ago I had notice sent me of a pair of Montagu Harriers which were supposed to be breeding upon one of an area of marshes which were to be mown in the following week. I was naturally anxious to inspect the nest and eggs or young of this fast disappearing species. Two rival marshmen eggers, both celebrated for their perspicuity, were at the time employed in mowing litter on adjacent marshes, and according to their own boast hardly a mingin (gnat) could stir without their noticing it, and each was as keen as possible to secure, for their respective patrons, any of the rarer birds or their still rarer eggs, and so the chances were against both the Harriers and myself. Arranging, therefore, with a trusty friend to keep watch all night over the suspected area, lest Josh or Tom should rob the nest at daybreak, I promised to bring my watcher his breakfast early. Needless to say that I was up before the lark in the morning, but having some miles to drive, and then some distance to boat, and being unable to resist the temptation to try a spin for perch *en route*, I was somewhat later than I had intended ere I reached my weary watchman in his reedy rendezvous. His greeting was neither complimentary nor very reassuring, but somewhat reproachful. "I kind o' gan yer up," he sung out; "Tom he come at daylight, and had a good spell at looking round, but he never found nothing, and I hain't caught a glint o' the Harriers. The male bird must be däad, don't he'd a brought her some wittals afore now; her eggs must be close on hatching, don't she'd a been off to feed afore this—p'raps she's gone an' all." However, after making a hearty old-fashioned breakfast, in which local barley essence took the place of tea, we made a prospect of the intercommunicating ditches, and anchored our flat-bottomed punt in what we thought would be the most likely coign of vantage for a view of the surrounding marshes. For six long hours we sat silently and watchfully without seeing the vestige of a hawk of any kind, when suddenly the third member of our party excitedly whispered, "There she be"; and sure enough there she was, flapping leisurely along above the tall reed tops in the distance. But where she had risen from not one of us could say, and soon whither she had gone was equally unknown, for through or over the distant reeds we could not see even with the aid of our good spying-glasses. For more than half an hour we again waited anxiously for her return: the sun was boiling hot, the heron-tinted gunwale of the boat was so strong a radiator as to sting our stockingless legs as we hung our feet in the water, and even the screw-stoppered bottles of refreshment might have spontaneously exploded had we not taken the precaution to sling them likewise overboard. Several Swallowtailed Butterflies and great big Tom Breezers (Dragon-flies) flitted by, Horse-flies and Thunder-bugs (midges) tarried with us longer than was pleasant, but the Harrier seemed to be gone for good—perhaps she knew that in the noontide hours of a blazing summer's day her uncovered eggs would long retain the necessary temperature to sustain the incipient life within. The further incubation has proceeded the longer may eggs be left by the parent bird. Last year, by mistake, I shut a Bantam off five hen's eggs for seven hours: they were in a wooden box about 3 feet square, and in the full sun. I broke one, and was surprised to find that the almost-fit-to-hatch chick was still alive: the remaining four are still inhabiting my poultry yard.

But to hark back to the Harrier, we eventually watched the bird to her nest, left her undisturbed, hurried home in a thunderstorm, and wired off for a photographer. On his arrival next day, too late for the light to take a portrait, I told him of the trouble and night-watching necessary, to make sure of seeing something when he brought his camera up to the spot. "Leave that to me," he said; and, knowing my man, I made no further inquiries or remonstrances, and it eventually transpired that he so pleased Josh and Tom, the suspects, with his exhibitions of the Highland fling and comic songs, mingled with a more than liberal supply of Highland spirits, that at turning-out-time neither of them felt inclined for birds'-nesting for the next twelve hours; ere which the profound student of Natural History had successfully exposed his plates on the nest and eggs of the Montagu—the bird herself being subsequently destroyed, and her perforce deserted eggshells are before me as I write.

Some Birds in Shakspear.

By J. L. Bevir, M.A.

The Raptores.

(*Continued from p. 137.*)

As hawking was largely indulged in throughout the middle ages, one would expect to find many references to it in Shakspear, and one is not disappointed ("2 Henry VI.," ii. 1). We have a royal party returning from the sport, where they have been "flying at the brook"—*i.e.*, hawking—after Heron and Waterfowl.

> "*Queen Margaret.* Believe me, lords, for flying at the brook,
> I saw not better sport these seven years' day,
> And, ten to one, *old Joan*[1] had not gone out.
>
> "*King H.* But what a point, my lord, your falcon made,
> And what a pitch she flew above the rest!
>
> "*Suffolk.* No marvel, and it like your majesty,
> My lord Protector's hawks do tower so well:
> They know their master loves to be aloft
> And bears his thoughts above the falcon's pitch."

In the "Merry Wives of Windsor" (iii. 4) we have milder sport, better becoming well-to-do citizens; for Page says, "After we'll a-birding together, I have a fine hawk for the bush."

With regard to the different sorts of Hawks used, I do not think I can do better than give the Faulkner's list in Walton's 'Compleat Angler,' and select from it those that occur in Shakspear:—

"You are to note that they are usually distinguished into two kinds, namely, the long-winged and short-winged Hawks: of the first kind there be chiefly in use among this nation—The Gerfalcon and

---

[1] I take "old Joan" to be Dame Juliana Berners, who lived in Henry VI.'s reign, and wrote a treatise on Falconry.

Jerkin; the Falcon or Tassel Gentel; the Laner and Laneret; the Bockerel and Bockeret; the Saker and Saceret; the Merlin and Jack Merlin; the Hobby and Jack.

"And there is of the short-winged hawks—The Eagle or Iron; the Goshawk and Tarcel; the Sparhawk and Musket. These are reckoned Hawks of note and worth, but we have also of an inferior rank—The Stanyel, the Ringtail; the Raven, the Buzzard; the Forked Kite (and others).

"Gentlemen, if I should enlarge my discourse to the observation of the Eires, the Brancher, the Ramish Hawk, the Haggard, and the two sorts of Lentners, and then treat of their several Ayries, their Mewings, rare order of casting and the renovation of their Feathers: their reclaiming, dyeting, and then to their rare stories of practice, it would be very much pleasure to me."

In dealing with Shakspear, it will be well to keep to this order. Firstly, then, of the long-winged Hawks. I can find no reference to the Gyr-falcon, which was very highly prized, as will be seen from reference to Norwegian kings and the like sending them as presents, unless indeed in that rather pantomimic scene where Stephano and Trinculo and Caliban approach Prospero's cell with malice aforethought, and are diverted by the clothes that Ariel has laid before them ("Tempest," iv. 1). Stephano twitching a jerkin off the clothes-line, says, "Mistress line, is not this my jerkin? Now is the jerkin under the line: now, jerkin, you are like to lose your hair, and prove a bald jerkin." It seems to me quite in keeping with Shakspear's love of punning, that in the last two jerkins he should be referring to the bird, for the Gyr-falcon was commonly called Jerkin in England.

According to the generally received ideas the Gyr-falcon was reserved for kings, owing to its scarcity in all but northern climes, and the difficulty then of getting at its nest and extracting the young. I believe that at the present moment it is the duty of Lord Derby to present our Sovereign with two such birds at his Coronation. Failing that, perhaps two Peregrines would do; for they, in the estimation of some, were attributes of royalty, as the Italian name Falco Reale (also called Falco Gentile) shows. I should think in all probability it was a Peregrine that our poet must have had in his mind when in "Macbeth" (v. 2), speaking of the omens which preceded Duncan's murder, he makes an old man say—

"On Tuesday last
A falcon towering in her pride of place
Was by a mousing owl hawked at and killed."

I have used the name Peregrine as applying to either gender, but as a matter of fact in falconry it was only used of the female, which is considerably larger than the male, and consequently flown at bigger quarry. The male, which was a third smaller, was called the Tiercel, Tercel, or Tassel. So when Juliet would call her Romeo back, she says ("Romeo and Juliet," ii. 2)—

"O, for a falconer's voice,
To lure this tassel-gentle back again!"

where Stevens and others take "gentle" as applying to the ease with which the male falcon is tamed, but this seems to me to miss the point of comparing the princely Romeo to a Falco Gentile.

The Haggard next claims attention, for Tuberville, White, and others speak of the Peregrine and Haggard as identical, which might find support in Spenser ("Faërie Queene," 1, xi. 19)—

"As hagard hawk, presuming to contend
With hardy fowl above his noble might,
His wearie pounces all in vain doth spend
To truss the prey too heavy for his flight,
Which coming down to ground, doth free itself in fight."

But it will be seen above that Walton did not regard the terms as interchangeable, and Littré's definition, Faucon hagard, "faucon qui a été pris après plus d'une mue, et qui ne s'apprivoise pas facilement" (a falcon taken after more than one mewing, and that is not easily tamed), is distinctly borne out by the use which Shakspear makes of the word. To him it is the Hag-ard, the Hedgehawk, the wild bird; so in speaking of Beatrice ("Much Ado About Nothing," iii. 1), "I know her spirits are as coy and wild as haggards of the rocks." And this is further brought out in the "Taming of the Shrew" (iv. 1), where Petruchio speaks of Kate, whom he has determined to tame by the most approved methods of falconry, as may be seen from the following quotation from Wood: "The first object which the trainer bears in mind is to reduce the strength of the bird by slow degrees, so as to prevent it from injuring itself by fierce and protracted struggles with which it would endeavour to resist any advances on the part of its teacher." Petruchio and his newly married wife are at the end of a long day's journey, she is very hungry, but he has quarrelled with every dish, and sent it away from the table, so that she has to go to bed unsatisfied.

> "My falcon now is sharp and passing empty;
> And till she stoop she must not be full-gorged,
> For then she never looks upon the lure.
> Another way I have to man my haggard,
> To make her come and know the keeper's call,
> That is, to watch her, as we watch those kites
> That bate and beat and will not be obedient."

Here he is obviously speaking of a hawk taken late, that is so confirmed in its wild habits that it will require much management to man it. One may succeed in taming a haggard, but it is unlikely that it will make a useful bird, as it is almost sure to keep to its wild habits and fly at anything whether the falconer wish it or no ("Twelfth Night," iii. 1)—

> "The fellow's wise enough to play the fool;
> And to do that well craves a kind of art.
> He must observe the mood on whom he jests,
> The quality of persons, and the time,
> Not, like the haggard, check at every feather
> That comes before his eye."

There is even a stronger instance of Shakspear's view of the meaning of the word, and that is in "Othello" (iii. 3)—

> "If I do prove her haggard,
> Though that her jesses were my dear heart-strings,
> I'd whistle her off, and let her down the wind
> To prey at fortune."

The falconer always flew his bird at the quarry against the wind, for it was very hard to recall a hawk if it went the other way. If he found the bird hopelessly intractable he let it down the wind, and so was rid of it; for the future she shifted for herself—"preyed at fortune."

A word or two on the training of hawks, which supplies Shakspear with so many similes that I will only take sufficient to describe the process. The bird, whether taken out of the nest or captured when full grown, was immediately hooded or hoodwinked, so Juliet says (Act iii. 2)—

> "Come civil night,
> Hood my unmann'd blood bating in my cheeks
> With thy black mantle."

The hawk was frequently fed, and when fed the trainer whistled to it that it might associate the sound with the idea of feeding. This is the falconer's call, though at times both in Italian and English it is used as "lure." The latter was properly a piece of leather covered with feathers upon which the hawk's food was placed, in order that later, when it was being flown and missed its bird, it might come back on seeing the lure, in hopes of being fed, as alluded to above in Petruchio's speech. When fairly tame it was carried on the gloved hand. "Straps of leather" (the jesses mentioned in "Othello") "were put about its legs for the purpose of holding it, and bells were attached, so small as not to impede its flight." These Shakspear mentions in "As You Like It," iii. 3—

> "As a falcon her bells, so man hath his desires."

And again, referring to the terror struck into other birds on hearing the bells of a hawk ("3 Henry VI.," 2)—

> "Neither the King nor he that loves him best
> Dare stir a wing if Warwick shakes his bells."

After this digression I return to two inferior birds in Walton's list, which find mention in Shakspear ("Merry Wives of Windsor," ii. 3). Falstaff's page, a shrewd little nipper, is called an "eyas musket," which is the equivalent of a young sparrow-hawk.

The Stanyel, too, is mentioned in the passage where

Malvolio is reading the note that has been set for him as a trap ("Twelfth Night," ii. 5)—the others are in hiding.

> *Fabian.* "What a dish of poison has she dressed him."
> *Sir Toby.* "And with what wing the stannyel checks at it."

One may add to this the question from the "Tempest," ii. 2, where Caliban is telling his new drunken master what he will do for him—

> "I'll bring thee
> To clustering filberds, and sometimes I'll get thee
> Young scamels from the rocks."

Many conjectures have been made to replace scamels: some read sea-mells, which might mean animals of a fish-like nature, or perhaps sea-mews; some, however, read "stannels." What is the meaning of stannel or stamyel, both of which forms are found applied to hawks? Richardson, of the Dictionary, and others take it to mean the Stone Hawk —*i.e.*, the Litho falco or Steinfalke of the Germans, which is the equivalent of the Merlin in England. But referring to Walton's list, it will be seen that he mentions the Merlin in his list of long-winged hawks (it was the bird assigned to ladies), whereas Stanyel with him comes among the inferior birds. Wherefore I conclude that he is really referring to the Kestrel, which, from its peculiar way of stopping in the middle of its flight quite motionless, was known as the Windover or Stand-gale, corrupted into Stannel. In falconry it was despised, and the yokel might fly it.

The Buzzard comes in the same category with the stanyel, and Shakspear, who must have known the sluggish bird that beat along the hillside for frogs or mice and little birds, does mention him, but whether from a falconry point of view I know not ("Taming of the Shrew," ii. 1)—

> "O slow-winged turtle, shall the buzzard take you?"

It was regarded as an inferior bird, as one may infer from "Richard III.," i. 1—

> "More pity that the eagle should be mewed
> While kites and buzzards prey at liberty."

In Cornwall the Buzzard is fairly common, and is called kite; in Devonshire even more so, where on the Basset estate they are preserved.

This finishes all the specific instances of hawks that I think it worth while alluding to, but before leaving the subject as a whole, I should like to take two more instances. The first is in "Hamlet," ii. 2, "I am but mad north-north-west: when the wind is southerly, I know a hawk from a handsaw." He is quoting a well-known proverb, "To know a hawk from a heronshaw." The word is a corruption of Heronsceau, a young heron, but used simply as the equivalent of heron. It is spelt in many ways, the commonest being heronsew, which one finds in details of feasts in Edward IV.'s reign, again in Henry VIII.'s, for the bird was highly prized for the table. In the eastern counties at the present day the people speak of the birds that flock on the Ouse as hansers, or hansaws, so one sees how the quotation came. As a child I always heard it called a Molly 'arn.

The other quotation is from "The Taming of the Shrew," Act ii., "Thou hast hawks will soar above the morning lark," with regard to which I cannot do better than quote from a letter of a friend of mine:—

"It was the end of August, the 30th or 31st, I fancy. We had come over the Bernardino Pass from Splügen the day before, and slept at San Bernardino, which lies in a little plateau, about two miles long, just below the upper zigzags of the pass. We left early the next morning (to get down to Bellinzona); and, after about two miles of straight road, came to the edge of the plateau, where the pass drops in a great cliff of nearly 3000 feet to Mesocco in the valley below. There from the tip of the cliff we could see, underneath us but high above the valley below, numbers of little hawks 'outsoaring the morning lark,' their backs and wings shining like dull metal in the morning sun."

That brings me to the end of the Raptores, with the exception of the ill-faced owl. I shall not stop over him; he has nothing distinctive about him, for when not engaged in acting death's dreadful messenger, he sings—

"Tu whit
Tu-who, a merry note
While greasy Joan doth keel the pot."

The Flowering of *Drosera rotundifolia*.

By James A. Greig.

The great value of the process of "self-fertilisation" possessed by some plants in perpetuating the species is well illustrated in the case of *Drosera rotundifolia*, an example of which came under my notice last year (1901).

I was living during August in the upper part of the parish of Balmaghie, in the Stewartry of Kirkcudbright, and within a few hundred yards of the house in which I resided there is a piece of moorland literally carpeted with *Drosera rotundifolia.* On August 2 I marked a number of these plants bearing flower-stems, and carefully watched these during August and into September. Each plant had one, two, or three flower-stems, with from six to twelve buds upon each. On August 2 two or three buds on one stem of each plant showed the points of the white petals still imbricated. On August 4 the weather broke, and there was rain with a low temperature for ten days. At the end of this time there was no difference discernible in the marked plants. A fortnight of fine warm weather then succeeded, the only apparent effect of this being to ripen the advanced buds, and to cause a few more on each stem to show white. This was the only indication of the flower that I saw, and I can hear of but very few people having seen the flower of *Drosera* fully blown, so that Mr Russell seems to have been very fortunate.[1] These flowers under observation never opened, and yet when I collected the plants in September *the capsules yielded abundance of seed.*

I have mentioned the large number of the plants of *Drosera* in this locality, and this was so noticeable that I thought at first they might be propagated by branches from the stem or from the root, or by leaf-bud. But on examination this proved not to be the case. The plants were seedlings, and presumably sprung from the seeds of cleistogamic flowers.

---

[1] Nature Notes, 1901, pp. 279, 280.

This, I think, is an example of the great benefit that the power of self-fertilisation confers on certain plants and in certain circumstances. This moor is 800 feet above the sea-level, is exposed to high winds and heavy rainfall, and even at midsummer to low temperatures. The weather that I experienced was far from being exceptional, and it is quite conceivable that many seasons may pass when cross-fertilisation by pollen from other plants is exceedingly difficult if not impossible of attainment. *Drosera*, with its scanty supply of weak roots, must depend under such conditions mostly upon its seed-bearing for its existence; and the chance of its survival would be poor indeed if that depended upon cross-fertilisation.

Record Photography.

By Alfred Watkins.

Is it not the case that a member of a Field Club, whatever branch of science he is most interested in, is emphatically one who makes notes? Mental notes they may be, written notes they ought to be, and how vastly helpful it is if pictorial or diagrammatic notes are added. Here it is that the aid of the camera should be called in, even if to supplement the work of a fairly skilled pencil, for the photograph—with its wealth of detail—occupies a different position to the simple sketch, each being superior to the other for its own purpose.

With such an end in view how vastly more interesting camera work becomes than if directed to the usual end of securing portraits, houses, and things which have only an interest personal to the photographer.

The geologist and archæologist especially can scarcely afford to neglect the camera. And yet how little has been done—for example—in landscape illustration of Physical Geography.

It is my aim once again to help with a few practical hints those who wish to take up this means of illustration, and who are not unlikely to be put on the wrong track by the photographic dealer, accustomed as he is to cater for the snap-shot man.

As regards choice of apparatus, all that I wrote in the May number applies to the present case, both as to size and style of camera. At the risk of being persistent I must repeat that it is very seldom that a snap-shot will be of use, and that in most cases the camera must be used on a stand. In fact, for the class of work I now write about a rapid shutter is not at all necessary, useful as it is for animal photography. There is one explanation I should add to what I previously wrote. It is now possible to obtain a camera racking out to double the focus of the lens, and with every movement desirable for architectural work, which is adapted for use on a stand, but is also designed to be available as a hand camera. Any objections which I have urged to a hand camera pure and simple does not apply to such as this.

The need for a long extension of camera is quite as needful as it was for animal photography, and for architectural work the camera must be provided with a swing back, or, what amounts to the same thing, a swing front. As regards choice of lens, an R.R. lens of the usual focal length for the size of plate, or a modern anastigmat of the same focus, will be the most generally useful, and if an extra one is added it should be a "single" lens of a focus about half as long again. It must not be forgotten that one of the combinations of the R.R. lens forms a "single" lens of double the length of focus, which is useful at times for taking an architectural "bit," which with the usual lens is too small on the plate. I need scarcely point out that the longer the focus of the lens the larger the size of the object on the plate, but the smaller the amount of object (or angle of view) included.

I should advise plates of medium—not excessive—rapidity to be used; and if architectural work is included, it is well to buy them ready "backed," which obviates that spreading of light round windows—called halation—which so often spoils a photograph of an interior.

In geological photography, whether of outdoor "exposures" (using the word in the geological, not the photographic, sense) or of rock specimens, careful lighting is important. In the former case the position of the subject should be studied and the time of day so selected that the sun is partially on one side and not directly behind the camera. In archæological work, too, this point is often of great importance, as a faint inscription which direct lighting makes almost invisible will often show up quite plainly if the sun's rays strike on it very much on one side. In such a case there is often only one hour of the day at which the work can be done to best advantage. The architectural student will probably do without a "wide-angle" lens for some time, as he will not want to compete with the professional in producing those views of the *whole* of a church or cathedral so much in evidence at the stationer's shop, but will want to secure records of *details* of work, such as windows, fonts, misereres, churchyard crosses, tombs, and brasses. Here the long extension to the camera will be found invaluable. There is one invaluable rule for work of this kind where upright lines are involved. It is to keep the back of the camera plumb upright. If the rising front will not secure enough of the top of the subject and the camera has to be tilted, the swing back of the camera is brought into play to secure this all-important uprightness of the plate.

Although the subject of exposure is an all-important one, I do not propose to add anything to my reference in the May number, except to note that an exposure must be sufficiently long to render on the sensitive plate all detail in the worst lighted (shadow) part of the subject, and that to avoid certain defects it must not very greatly exceed this minimum.

As regards development, I am free to give a few hints on general principles. Just as in exposing a plate rendering of detail only need be considered, so in developing it the question of contrast between the highest and lowest tones is the one point to consider. And the rule is a simple one. Too short a time for development secures only a feeble contrast in the finished photograph, which is flat and grey. On the other hand, if the plate is left in the developer for too long a time, the contrast between the tones is too great, and a "hard" picture, in which sunlighted parts look as if snow has been falling, results.

In other words, the contrast between the tones is regulated by the length of development. The best and simplest plan is, in my opinion, to keep to one formula of developer, and to develop for such a time that a contrast between the tones results correctly representing the natural subject. In winter this time is much longer than in summer, and it also varies with accidental variations in the developing solution.

I discovered that an observation of the time of appearance of the image on the plate gives an exact measure of the activity of the developer and enables the desired contrast in the negative to be secured by timing alone.

Let me give practical details. Nothing better than a pyro-soda developer can be used, and I will presume that a well-known formula — that given for Ilford plates — is followed, the smaller amount of pyro mentioned in the formula being used. If with this developer the time of appearance of the image is noted and the plate left in for a total of 5½ times this time, a negative of standard contrast will be secured at any time of the year.

The procedure is as follows: Having plate and developer ready, take out your watch, and when the hand touches an even minute pour on the developer. Begin at once to count seconds and note the number at the first appearance (watching closely) of any trace of image on the creamy surface. This number of seconds is the time of appearance, and 5½ times the appearance is the total time to develop. Thus, the image appears in 30 seconds, and it must be developed for 165 seconds or 2¾ minutes from the moment of pouring on the developer. The 5½ times is called the multiplying factor, and expresses the choice of the photographer in the contrast required in the print. If for a special subject an extra amount of contrast is required in the print, a larger factor (longer development) must be used, and a shorter factor if the contrast in the subject is required to be subdued. Different developers and different formulæ require different factors, but the factor does not require altering for different makes of plate.

This plan of controlling development takes the place of the older plan (as given in most platemakers' instructions) of altering the proportions of the developer to control results, and is, I know from long use of it, quite efficient for a wide range of subjects, and enables a negative to be correctly developed even after a long interval of no photographic work.

Small objects—such as fossils, shells, fungi, &c.—are best photographed by the shadowless method, placing them on a horizontal pane of glass. This plan is more fully described in the May number, and the method there described of marking the base board of the camera for definite degrees of reduction will also be useful for systematic work.

As regards printing methods, I feel sure that those who will "make the plunge," and boldly attempt either the carbon or the platinum process, will find either to be actually easier to work than the usual printing-out paper, with the great advantage of absolute permanence and uniformity of tone or colour.

Norman Architecture.—II.

By Rev. P. J. Oliver Minos, Ph.D., M.R.A.S. (Lond.)

In my first article of this series I pointed out the general characteristics of the Norman[1] style of architecture; in my second I will draw attention to some special predominating features of this style.

The chief features of the Norman style consist in the predominance of horizontal rather than vertical lines, in heavy semicircular arches,[2] in short or stunted massive round pillars of one shaft, and in large plain capitals and square abaci surrounding piers and shafts. These can be studied to advantage in the cathedrals of Durham, Canterbury, Rochester, Peterborough, Norwich, Oxford, Winchester, &c.; but for members of field-clubs on their field-day rambles the country churches would naturally be more in their way. Therefore illustrations of country churches will be made use of in this article.

---

[1] The French do not use the word Norman: they divide Romanesque into (1) *primitive* (fifth to tenth century), (2) *secondary* (tenth to eleventh century), and (3) *transition* (twelfth century).

[2] The Assyrians seem to have been the first nation using the semicircular arch; the Etruscans were the next.

In the Norman period porches were very rare; yet a Norman church doorway is frequently met with beneath a protecting porch of a much later period. The Norman builder preferred to thicken the wall where the door was to be set, and to let this thicker wall stand forward with a slightly projecting gable. The wall immediately under the gable is then made to recede in stages bounded by mouldings, until the decreasing thickness of wall coincides with the thickness of the door-frame. This contrivance not only relieved the weight on the door-frame, but also added dignity and importance to the head-arch by reason of rings of mouldings and depth of light and shade in the deep recess. A porch was, therefore, not wanted; in fact, a porch would only serve to place the Norman light under a bushel!

The Normans always strove to make the principal church doorway a very prominent feature of the church. Such doorways were not always at the west end; and we find them on the south side, not far from the west end, rather than on the north. It was of no consequence to the Norman builder where the principal entrance to a church was placed; but it was of great consequence to him that the principal entrance should arrest attention. I look upon the Norman church-builder as a devout Christian, who took great pains to so construct the principal church doorway that it should be a speaking doorway to all church-goers. Accordingly, mouldings of doorways were generally ornamented with much carving, either of patterns, or foliage, or strange beasts. During the Transition period pillars and sculptures were inserted to heighten the grandeur and add to the general effect. With regard to sculpture, it may be noticed that early Norman work is always rude and cut in low relief. But deep or shallow carving depend very much upon the quality of the stone employed: on soft stone deeply-cut works were cut; on hard stone shallow-cut works were cut for the very simple reason that they would be sufficiently lasting, and quite as lasting as deeply-cut works on soft stone. Another characteristic mark of Norman sculptures is that the sculptures of the earlier period were such as could be done with the axe; those of the later period were such as could be done by means of the chisel. Therefore the earlier sculptures show signs of chipping off (generally attributed to frost or vandals); whereas the later sculptures show signs of chisel-marks without the smoothness or polish of modern works.

The head of the Norman church doorway is usually semicircular; but sometimes it is square-headed, the space where the lintel or straight beam would have been being filled up with a stone slab technically called the tympanum. Of this the western doorway of Rochester Cathedral is a good example. I cannot call to mind a single instance where the tympanum is used *plain*—*i.e.*, without a subject carved on it. I think this increased space gave the devout Norman builder another opportunity for making his principal church doorway prominent. The following are some of the Scriptural subjects commonly found carved on the tympanum: (1) "The Tree of Life"; (2) "I am the Door"; (3) "The Good Shepherd"; (4) "The Lamb of God"; (5) "The Virgin and the Child," &c. With the fashion of utilising the tympanum for illustrating Scriptural subjects came the idea of similarly utilising the piers, capitals, &c., of the principal doorway. Thus a connected (if not complete) symbolism of 'Paradise Lost,' or 'Paradise Regained,' or both, came to be carved. For an illustration let us look at the south doorway of St David's Church, Kilpeck, Herefordshire.[1] The carvings on the upper margin of the semicircular head are intended to represent the animal creation, and in their midst large *eyes* are carved to symbolise "God saw." The *harp* symbolises harmony or "that it was good." On the tympanum is the hypothetical representation of "the Tree of Life." On the doorpost or piers are to be noticed the "serpent," primitive man, and the intertwinings of good and evil.

Next to the doorways, the Normans paid great care and attention to the arch separating the choir from the nave. These arches are also semicircular throughout the whole of the Norman period. The earliest chancel arches were generally plain; and, if the zigzag ornament was used before 1150 or 1160, it was of a flat character, free from hollows and without "undercutting," and divided from the plain surface by mere notches. In the earlier Norman work mouldings on the arch and elsewhere are generally square in section, or with the sharp edge sloped or bevelled off, or chamfered. Later on roll-mouldings were cut on the edges—*i.e.*, the sharp edges were rounded instead of being chamfered. Still later on, the number of such rolls was increased, but without affecting the general squareness of section of the groups of mouldings as a whole, therefore without altering the general effect of light and shade from a distance. Enriched mouldings or ornaments include the chevron or zigzag, the square or round billet, the sunk star, the hatch, the cable, the lozenge, the chain, the nail-head, &c. The commonest of these was the zigzag. In very early Norman work it was simply incised or in low relief. An abundance of zigzag simple or complex is nearly always a sign of late Norman work, and in late Norman work of the reign of Henry II. or perhaps of King Stephen. The Knights Templars' Church at Garway, Herefordshire, has a handsome chancel arch of this late period.[1]

---

[1] This will be described and illustrated in a future issue of the F.N.Q.—Ed.

In conclusion, let me ask what suggested the zigzag? Some have hinted that the zigzag is a modified form of the undulated moulding; but I rather feel inclined to think that the zigzag was suggested by the zigzag flashes of the lightning. As the semicircular arch represents the sky above, the star mouldings the shiny orbs, so the zigzags represent the lightning[2] or light itself.

---

[1] A special article on this interesting church (illustrated) will appear later.—Ed.

[2] A tolerably convincing proof that the ancients associated the snake with sun or fire is seen in a bronze brooch found a few years ago on excavating the site of a Roman camp on the Saalberg, not far from Frankfort-on-the-Main: it is now in the Kursaal Museum at Homburg.

The Field Naturalist's Library.

REVIEWS OF BOOKS, PERIODICALS, ETC.

MAMMALIA. By Frank Evers Beddard, M.A., F.R.S. London: Macmillan & Co. Vol. x. The Cambridge Natural History. Price 17s. net.

In our last issue we drew the attention of our readers to volume viii. of this series, Dr Gadow's excellent 'Amphibia and Reptiles.' Volume x. on 'Mammalia' has now appeared, and it may be said at once that Mr Beddard has produced, as every one expected he would, a most attractive account of this class. One would naturally suppose that Mr Beddard's position as vice-secretary and prosector to the Zoological Society of London would ensure due attention being paid to the habits and characteristics of animals in their living state, as well as careful study of their structure. The result is one all too rare in zoological textbooks, a judicious combination of the morphological and physiological aspects of mammalian life. Whatever morphological specialists may think, the result from the field naturalist's point of view is most pleasing. Not that morphology is neglected in this work, far from it, but that in addition the reader gets an adequate idea of the distribution, habits, and evolution of the more important animals of the class.

Discussing the interesting question of the possible forerunners of the mammalia, Mr Beddard concludes that "we shall probably not go far wrong in the present state of our knowledge if we assign the origin of mammals to some type which would be included in the order Theriodontia, or at least in the sub-class Theromorpha," reptiles belonging to the extinct Permian and Triassic group. The question of telegony, on which so much has been written in recent years, is not discussed at length, Mr Beddard contenting himself with one reference to it as "that rather doubtfully-occurring phenomenon." He might have gone further and said that experimental evidence seems to point to its non-existence. With the exception of this question, the section on the Ungulates is very thoroughly done, for, as our author says, "a book upon the history of mammals would be incomplete without some account of that well-ascertained series of forms which seem to connect the primitive Perissodactyles with the modern horse."

Possibly the price of the volumes in this series may be a bar to many field workers becoming possessed of them all, but as works of reference for the field club library they are to be highly recommended, and all secretaries of such societies would do well to advise their committees to obtain the two volumes we have referred to for the benefit of members.

THE FACE OF NATURE. By Rev. C. T. Ovenden, D.D. London: John Murray. Home and School Library. Price 2s.

"The main object of this book is to afford recreation and instruction on winter evenings in the form of popular lectures on scientific subjects, which can be easily understood by such mixed audiences as a clergyman or a layman can gather together in a parish hall." As the layman who is asked to undertake such a task is frequently a field naturalist, this little book may be recommended as a useful guide on the subjects taken up. These subjects are—Weather Forecasting, Vegetable Life, The Record of the Rocks, The Story of a Common Stone, and in an appendix The Preparation of Lantern-Slides. Of these, the section on The Record of the Rocks is, in our opinion, by far the best, the matter being excellently arranged for dealing with before a non-scientific audience. As this is an English work, it is somewhat puzzling to know why the author spells the name of the green colouring matter of plants as "chloro*phil*." A very useful feature is the drawing of many illustrations in outline, which could be reproduced on a blackboard, or from which slides could be made.

THE STARS IN SONG AND LEGEND. By Jermain G. Porter, Ph.D. Boston and London: Ginn & Co. Price 2s.

In his preface Professor Porter says that he has "attempted to present the legendary lore of the heavens in such a way as to attract the unprofessional reader." By numerous poetical quotations he has also "tried to show the intimate connection of the stars with the best and highest in literature." It need only be said that in both directions he has ably succeeded, the subject being presented in a most attractive and non-technical manner, the explanatory illustrations being as good as the text.

SECRETS OF THE WOODS. By William J. Long. Boston and London: Ginn & Co. Price 2s.

"Another chapter in the shy, wild life of the fields and woods." Written evidently for juvenile American readers, who doubtless will readily understand much that English children would be puzzled by. Thus the book is dedicated to "Ch'Geegee-Lokh-Sis," whose coming makes the winter glad,—a fact that readers this side the Atlantic may be pardoned for not knowing. But there is much that is most enjoyable reading, even for our young lovers of animals, and the hints on observing of wild animals in their natural habitats contain capital advice.

FIRST STUDIES OF PLANT LIFE. By George Francis Atkinson, Ph.B. Boston and London: Ginn & Co. Price 2s. 6d.

If the current methods of teaching boys and girls in America are accurately reflected in the series of books under notice, then we are regretfully driven to conclude that we in this country are lamentably behind our cousins. Nature study is at last taking its rightful place in the education of this country to some extent, but we are afraid that it still consists to a great degree "of pulling flowers to pieces and finding their Latin names," solely with a view to accuracy of classification.

It is indeed true that "the child cares very little about the forms of things; he is far more interested in what things do." "Nature study is not synthetic; it takes for its central thought the child, and for its field work the child's natural environment. The child, through nature study, learns to know the life-history of the violet growing in his own dooryard, and the fascinating story of the robin nesting in the cornice of his own porch. The differences of this violet and this robin from other violets and other robins in the world he considers not at all." "In this book the plant stands before the child as a living being with needs like his own. He realises that the young plant must be fed; it must grow; it is no longer a matter of commonplace; it is replete with interest, because it is the struggle of an individual to live. How does it get its food? How does it grow? It is of little moment whether its leaves are lanceolate or palmate; it is a question of what the leaves do for the plant."

The sentences quoted are from the introduction to this book, and are written by Anna Comstock, of Cornell University, for the author. In our opinion they go right to the foundation of true teaching of nature study for children. Let the child learn to look upon the plant or animal first of all as a living entity, and later on it will be time enough to introduce him to the technicalities of minute structure and precise classification. We strongly advise parents who are endeavouring to inculcate a love of nature study in their children to proceed on the lines of this book, which for plant life will be found an excellent introduction. The work should be carefully studied by all whose duty it is to instruct in nature study in plants.

INVERTEBRATE ZOOLOGY. By Henry Sherring Pratt, Ph.D. Boston and London: Ginn & Co. Price 6s.

This book is evidently particularly adapted for Professor Pratt's own course of Invertebrate Zoology, or at any rate for a course of Invertebrate Zoology in America. Nevertheless, teachers and students in this country will find it of use. A very useful portion is the appendix, which consists of the Classification of Animals, Short Definitions of the Principal Groups of the Animal Kingdom, and a Glossary of Terms. Unfortunately in parts of this appendix accuracy seems to have been made subservient to brevity. Thus a nephridium is defined as "a urinary tubule in annelids," whereas nephridia are not confined to annelids, and are, moreover, tubules opening typically both into the body cavity and to the exterior. Then an otocyst is said to be "an organ of hearing," which is, to say the least of it, somewhat doubtful. Many regard the otocyst as being concerned in equilibration. The Anthozoa should not be classified as a subdivision of the Scyphozoa, but as a separate class of the Cnidaria. *Æolis* is given as the example of the Opisthobranchiata; *Aplysia* would be much more typical. In the same way *Synapta*, which is the example given of the Holothuroidea, is one of the most modified members of that class, inasmuch as the five typical zones of tube feet are entirely wanting. Possibly the author regards the appendix as the least important part of the book, but it is a decidedly useful part, which might be much improved by alteration of a few such points as indicated above. For the descriptive portion we have nothing but praise. The types are clearly described, and definite instructions given for dissection and observation, whilst the student is aided in his reading by the names of organs, &c., being printed in bold type. Teachers will find this a useful book for students of scientific or medical courses of invertebrate zoology.

THE WATKINS MANUAL OF EXPOSURE AND DEVELOPMENT. By Alfred Watkins. London: Geo. Houghton & Son. Price 1s. net.

Mr Watkins, who is president of the Herefordshire Photographic Society and a member of the Woolhope Field Club, has given his readers in this little book a most practical and handy manual of instruction in all the difficulties that beset the amateur photographer. The author is well known as the introducer of two widely used methods of exposure and development, and those who have had the pleasure of seeing his own photographic work, as we have had, will be glad to have the practical experience of a master of the art reduced to such a convenient compass. Definite instructions are given on those three important points: How long to expose, How long to develop, and How long (or how much) to tone; and the photographer who carefully attends to the warnings and advice in this book cannot fail to find his work much improved, and will have the gratification of seeing his greatest difficulties vanish. We heartily commend 'The Watkins Manual' to all field naturalist and other photographers.

BIRD-HUNTING ON THE WHITE NILE. By Harry F. Witherby, F.Z.S. London: 'Knowledge' Office. Price 2s. 6d.

"The journey, of which this little book forms a narrative, was undertaken for the sole purpose of endeavouring to add to our knowledge of the birds and beasts of the Soudan." A very pleasant narrative it is, but by no means confined to birds and beasts, for there are many interesting details given of the customs of the natives also. Mr Witherby adds useful information on the Game Laws of the Soudan, and instructions as to the kind of photographic apparatus necessary for success in that climate. The illustrations are from photographs by Mr C. F. Camburn, who accompanied the author, and by Mr A. F. R. Wollaston, who visited the Soudan in 1901. Most of the chapters appeared in 'Knowledge' last year, and to these have been added appendices of the birds and mammals seen and collected.

THE NATURALIST ON THE THAMES. By C. J. Cornish, F.Z.S. London: Seeley & Co. Price 7s. 6d.

Mr Cornish is well known to field naturalists of the Thames district as a writer on the varied natural history of that locality. Much of the matter of this book has previously appeared in the 'Spectator,' 'Country Life,' and the 'Badminton Magazine'; but as the articles were written with a view to publication in the form of a commentary on the natural history and character of the Thames Valley as a whole, the work does not suffer from the lack of continuity often associated with reprints. The illustrations are particularly good, as one would expect from such artists as R. B. Lodge, Charles Reid, and E. Seeley, the last of whom gives some beautiful fish photographs. Field naturalists of the Thames Valley will welcome this book.

A TREATISE ON THE BIRDS OF GLOUCESTERSHIRE. By W. L. Mellersh, M.A. London: R. H. Porter. Price 5s.

The object of this work is "to present the chief features of the life of wild birds as specially connected with Gloucestershire." Books on county fauna are very apt to consist merely of a descriptive catalogue of the species found, but this reproach does not apply to Mr Mellersh's volume, which is a scientific treatise on the ornithology of Gloucestershire. That is to say, the birds are discussed from the point of view of the county, which is too often just what is not done. The county is divided into districts according to the surface conditions, three land areas, corresponding almost with the three geological divisions of the county, and a fourth area—the Severn District. There is a complete Glossary given of local names for birds, showing to what extent and where the names are used, and an excellent Reference List and Index. The illustrations are from reductions of original drawings by Mr Edward Neale, and though in an unusual style, are very effective. Mr Mellersh's book should be in the hands of all Gloucestershire ornithologists. In any future edition we should advise that the map of the county be inserted as a single page, not a folding sheet, Folding maps in books are apt to suffer mutilation, and this one is small enough to insert unfolded.

A HANDBOOK OF BRITISH BUTTERFLIES. By J. R. Charnley, F.E.S. London: Simpkin, Marshall, Hamilton, Kent, & Co. Price 6d.

This handbook "only pretends to furnish a few brief and elementary notes on each species, and though not intended for the experienced collector, will, it is hoped, prove useful as a pocket companion to the young entomologist." Sixty-five species are noticed, the reputed species being entirely omitted. The information given includes the distribution and abundance of the species, the food-plants of the larva, the time of appearance, and the favourite places of resort. One side of the pages is left blank for notes, a useful feature for the collector. The handbook should answer its purpose and prove useful.

AGRICULTURAL BOTANY, Theoretical and Practical. By John Percival, M.A. London: Duckworth & Co. Second Edition. Price 7s. 6d. net.

That a second edition of this work should be called for so soon after its first appearance is the best possible proof that the book supplied a want. And indeed it would be difficult to speak too highly of its value to student, teacher, and practical agriculturist alike. In its 786 pages the following sections are dealt with in turn: General External Morphology, Internal Morphology, Physiology of Plants, Classification and special Botany of Farm Crops, Weeds of the Farm, Farm Seeds, Fungi (considered chiefly in relation to some common diseases of plants), and lastly Bacteria. Perhaps the most interesting chapters to the general biological reader are the three dealing with Reproduction and Breeding, in which the phenomenon which we know as Heredity is discussed, and in which many examples are given of the results of self-fertilisation, cross-fertilisation, hybridisation, variations in offspring, reversion or "throwing-back," and degeneration of varieties. These are problems which are much in the biological air at present, and we advise those who wish to get a clear description of these phenomena in the plant world to carefully study these chapters. Every cultivator of flowers, fruits, or crops should possess this valuable book. It well deserves the success it has already met with.

NATURE STUDY AND LIFE. By Clifton F. Hodge, Ph.D. London: Ginn & Co. Price 7s.

A treatise such as this, consisting of over 500 pages and illustrated with nearly 200 sketches and pictures, written by a teacher to teachers and scholars, deserves the name of an epitome of the subject. The binding and letterpress are in good style, and the illustrations are particularly good in the section dealing with insect life.

Mr Hodge's work is on sound pedagogical lines; and, indeed, it would be less than just were the pioneer work of America in this branch of literature not frankly acknowledged.

The subject of Nature Study has exercised the teaching profession on this side of the Atlantic for years. What to leave out is a troublous question; while what to include, and how to do it, is perhaps an even more difficult problem. Mr Hodge's book goes a long way towards the direct solution of both these questions, and is full of suggestiveness.

To know things, he advocates, is better than to know about things; and to know things at first hand is better than to know them only as illustrations, however well shown, in class lessons. He rightly places the book of Nature first and perhaps alone, as the teacher's guide. Consequently the keeping of pets by children is regarded as of high importance in bringing the child into sympathy with nature. The home and how to support it and beautify it with the products of cultivation; how to rid these and protect them from the inroads of pests; the life-history of these pests, and what conduces to their superabundant propagation; sanitation in relation to plant and animal life as aiding or militating against human existence; taming animals, common and uncommon,—all these are made the subjects of lucid remark, philosophic observation, and—not least—of practical laboratory instruction. The guidance given on bee-keeping, school gardens, grafting and budding, the mounting of insects and the preservation of specimens (although "mounting" and "specimen" do not occur in an Index generally good) is deserving of high praise.

The opening chapter of "The Point of View" might well have been compressed into a two-page introduction, and the Introduction, as it stands, omitted. The titling of paragraphs, stricter regard to style, and the inclusion of certain charts and tables in an appendix instead of in the body of the text, would enhance the charm of a work which is thoroughly refreshing, earnest, and practical. The second edition—which we expect will soon be demanded—will not suffer by some compression. This book will make its way on its merits, which are indisputable, and we congratulate the author and his publishers on giving to the English-speaking public this epitome of an entrancing subject.

WILD-BIRD PROTECTION AND NESTING-BOXES. By John R. B. Masefield, M.A. Leeds: Taylor Brothers. Price 5s.

This is a delightful book, written by a well-known field naturalist. Mr Masefield is vice-president of the North Staffordshire Field Club, and chairman of its Zoology section, and some of his contributions to the club's annual report are noticed elsewhere. We are particularly glad to draw the attention of our readers to this book just now, since the question of wild-bird protection is discussed in our pages of this issue, and is one which much engages the thought of field naturalists at the present time. Of the many methods of encouraging the breeding of wild birds in gardens and woods, none are more interesting than those described here by Mr Masefield, and so excellently illustrated. The nine plates show some of the various designs of boxes and brackets that have actually been used by wild birds as nesting-places, and the exact situations on trees or buildings in which they were placed. In addition to this the book contains a full list of the Orders made under the Wild Birds Protection Acts on the application of county councils, with the names of the species protected in each county—a most useful section of the work. The result of the methods described can best be judged by the fact that Mr Masefield mentions no less than thirty-six species of land birds that he has induced to nest in and around his own garden, shrubbery, and buildings, in two or three years. A most delightful record of practical ornithology from the field naturalists' point of view.

ELEMENTARY PHYSICAL GEOGRAPHY. By William Morris Davis. Boston and London: Ginn & Co. Price 5s. 6d.

This book, by Professor Davis of Harvard University, is a reduction in size of the same writer's 'Physical Geography,' by omitting the more advanced problems, and simplifying the treatment of the remainder. The Atmosphere is, however, treated at greater length than before, and a new chapter added on The Distribution of Plants, Animals, and Man, so that the total bulk is not much less than the original volume. This new chapter is one of the most interesting in the volume, and deals with Life on the Earth, Geographical Factors in the Struggle for Existence, Variation of Plants and Animals, Life in the Seas and on the Lands, Life on the Continents, and Races of Mankind. Life on Islands, and the influence of Climate on Distribution of Plants and Animals as well as on the Customs of Savage Tribes, are headings of thoughtful paragraphs, while Seasons, Mountains, Deserts, and Oases are all allotted their place in the distribution of organic forms. There is an Appendix of references for supplementary reading and references for maps. The original 'Physical Geography' and this 'Elementary Physical Geography' are both very serviceable volumes for teachers and students of the subject.

TREES IN PROSE AND POETRY. By Gertrude L. Stone and M. Grace Fickett. Boston and London: Ginn & Co. Price 2s.

Another of the American schoolroom books of aid to Nature Study. It consists of selections from the writings of Longfellow, Lowell, Whittier, Oliver Wendell Holmes, Hawthorne, Burroughs, Thoreau, Aldrich, Bryant, Wordsworth, Ruskin, Hood, Rosetti, Tennyson, and others; together with a general outline for the study of trees and a reference list of twenty-five historical American trees. Most of the gems of literature regarding trees are here, and a chapter of explanatory notes added. The selections are grouped in the natural orders of the trees — *e.g.*, the Maple Family, the Rose Family, the Pine Family, and so forth. A good idea well carried out.

Field Clubs and Societies.

The Annual Report of the North Staffordshire Field Club (vol. xxxvi.) testifies to a large amount of valuable work done in the various sections, and a membership of 466 points to a vigorous institution. Mr Masefield, in his report for the Zoology section, gives the result of the revision of the list of Staffordshire birds on which he has been engaged for some time. Two new species of wild birds are added to the county list, the Shore Lark and the Flamingo. Other species have been removed from the list on account of doubtful authenticity, thus reducing the recorded species to 214, of which 103 are believed to be still breeding in the county area. A note of a ring snake, 9 inches long, taken in August, evidently refers to one recently hatched out, in all probability a week or two before capture. Mr Masefield also contributes a very valuable paper on the Staffordshire Mollusca, 98 species being recorded. The rufous variety of the Common Partridge is the subject of another communication from the same writer, illustrated by an excellent coloured plate from a drawing by Mr L. H. Jahn. Mr E. D. Bostock reports the addition of *Eupithecia satyrata* and *Mamestra anceps* to the county list of Lepidoptera, along with other Entomological records. Dr W. Hind gives a list of localities where fossils occur in the Pendleside series of the country round North Staffordshire, with two plates. Other noteworthy contributions include "The Limes Britannicus," by Rev. T. Barns; "Meteorology," by Mr Wells Bladen; "Our Own County," by Rev. F. J. Wrottesley; and descriptive reports of the various excursions and meetings. The volume is a most interesting record of good work.

The Wellington College Natural Science Society Report for 1901 gives reports of thirteen lectures, a meteorological report for all the months of the year, together with the sectional reports. In the Ornithological section we note the appearance of a Pine Grosbeak, seen first on November 17, and afterwards on several later dates. In the Geology report is an illustration of Eolithic Flint Implements, found on Finchampstead Ridges.

The Epsom College Natural History Society Report for 1901 gives evidence of much interest taken in the subject, a membership of 104 in the summer term being decidedly encouraging. In the Botanical report we note the recording of *Centaurea calcitrapa*, a plant quite new to the district. *Senecio campestris* was seen again after disappearing for some years. A very useful feature is the list of plants observed, with dates of first blossoms seen, which serves as a basis of comparison with other seasons. The field work in Entomology resulted in the addition of thirty specimens to the previous lists, the captures including the Camberwell Beauty, the Feathered Dart, and the Lappet. The Meteorological observations are illustrated by monthly charts ; and an unusual section is the record of the weights and measurement of 240 boys, some of the data being very interesting.

The Third Annual Report of the Northumberland Coast Club finds the club with a membership of 103, and it is gratifying to note that this indicates a steady increase. This society has for its objects the study of the Marine Zoology of the county, and also the Archæology, Folklore, History, Geography, and Geology of the coast. The field of work thus offered is wide, and as the club gets older much valuable investigation should result. Good work has already been done, and with a view to encouraging the members, prizes are offered in Botany for collections of Seaweeds, in Zoology for the best collection of Echinoderms, and for essays on any subjects within the scope of the club's work. We wish the society a long and prosperous career.

Correspondence.

"In 1893, on September 15 or 16, when returning from South Africa in the Doune Castle, just after passing Cape Verde we were met with very strong trade-winds on the port side. They were so strong that the ship was retarded some 70 knots per day, and nothing but crested billows were to be seen. I was in the bows as usual looking over the water, when suddenly close along the top of the water flying with the wind came a butterfly. It looked like a 'Copper' butterfly, the size of a 'Chalk-hill Blue.' I was amazed to see it actually amongst the spray, but in about twenty minutes I saw a second one. I do not know how they could have come off the shore some fifty miles away against the wind, and can only suppose that they came from the Cape Verde Islands some two hundred miles off. In any case the distance from land was enormous, I should think, for a butterfly, especially considering the weather conditions, and the position of the butterfly right amongst the spray. It only shows how easily Continental species might cross the English Channel, and how some of the doubtful specimens may well have crossed without human agency.

"Mr H. Rowland-Brown may also like to know that on Peace Day I saw many 'Grizzled Skippers' up an open lane leading from the

Cotswolds to the Severn Valley, settling, as he described the Skippers in the Alps in the last issue of the F. N. Q., on sand recently deposited by an overflowing side stream over the lane."—W. Mellersh, The Gryphons, Cheltenham.

With reference to Mr Mellersh's above letter, Mr Rowland-Brown writes: "With regard to your correspondent's note *re* Migration there is a series of papers still in progress on the subject in the 'Entomologist's Record,' by Mr J. W. Tutt, who is collecting all the evidence available on the subject. It seems to me that unless the species is identified it is difficult to say whence it may have come. But probably these insects were blown *nolens volens* from the African coast, if they were not part of a migratory swarm. Some *Lycænids* migrate; notably *Lampides bœticus*, the Long-tailed Blue, which occurs in Africa, Asia, and Australia, and sometimes penetrates as far north as England, being taken in 1899 in some quantities in the Channel Islands. A specimen exhibited by Mr H. W. Shepheard-Walwyn, on June 5 at a meeting of the Entomological Society, was caught at Winchester in that year. But it is interesting to note that those observed and taken in the Channel Islands in 1899 were almost entirely confined to the male sex."

"Can you or any of your readers give a full copy of Dr Jenner's poetical weather rhymes, one stanza of which was quoted in the 'British Medical Journal' for July 5?"—"Squid."

"Is it of common occurrence for weasels to hunt moles in their runs from 6 to 8 inches underground? A few days ago I visited some mole-traps with a friend, and in one of the traps was caught a weasel. The wire noose had closed on him nearer the tail than the head; the weasel had then turned and the head and tail were touching outside the barrel of the trap."—Thomas Thompson, Winlaton.

"May I ask if you or any of your readers know if there is any record in hand, or completed, of the boulders or erratics of Norfolk? Basalt and granite boulders are common in this district, and I should be glad to put my pupils on their cycles by way of helping such a record. They would locate the boulders; we—my colleagues and myself—would afterwards go and verify and break off hand specimens for any properly constituted body undertaking the record."—Harry Lowerison (Principal, Ruskin School-Home, Heacham-on-Sea).

(We know of no such record: but the county field clubs would doubtless gladly record such observations in Transactions, and probably there are museums in the county that would like a series of such specimens. —Ed. *F. N. Q.*)

"I would be very glad if you could tell me of an active Field Naturalist Club within reach of one living at Twickenham. I have been unable to hear of such a club."—B., Twickenham.

(We shall be glad to put this correspondent in communication with any secretary in the district named, who will write for his address.—Ed.)

Answers to Correspondents.

PEAKITE, Derby.

The paper to which you refer is full of misleading statements. The Slow-worm, *Anguis fragilis*, does not belong to the family of the Skinks (the *Scincidæ*), but to the family *Anguidæ*. Both families belong to the sub-order *Lacertæ* of the order *Lacertilia*, Lizards. If by the Scaly Lizard is meant the Sand Lizard, *Lacerta agilis*, it is unpardonable in the absence of any stated record to assume that it is plentiful in some localities in the county. The Sand Lizard is practically confined to a few districts in the south of England. "Axolott" is probably a misprint for "Axolotyl," or "Axolotl," the larval form of *Amblystoma*, in which there are three pairs of external gills persistent. Batrachians are, of course, not reptiles at all; either true or false, the term is synonymous with "Amphibia." Reptiles have a covering of scales, and breathe from birth by lungs only, whilst Amphibians in the young stage breathe by gills. Moreover, in recent Amphibians the skull articulates with the first vertebra by two condyles. It is quite common to find a somewhat savage disposition in Slow-worms, especially in the breeding season.

S. F., Edinburgh.

Your friend is wrong in imagining that parr are a distinct species of fish. They are a stage in the life-history of the salmon. At this stage the young fish exhibit a barred colouration. It is quite true that these parr can fertilise ova by depositing milt, but that alone does not prove them a distinct species; it merely signifies that the young males are sexually mature. The point is, that the female parr never develop to maturity unless they go down to the sea. They return as grilse, enormously increased in size, from ounces to pounds in weight, and may spawn on their return to fresh water. The stages generally recognised are, in order of youth to adult fish, Fry, Parr, Smolt, Grilse, Kelt, Salmon.

The eel, on the other hand, spawns only in salt water; and it is said that the old eels, after spawning, do not return to fresh water. The young elvers, as they are called, are seen ascending the rivers in summer in thousands, but no old eels. They are able to wriggle through wet grass, and so probably stock inland ponds.

FOSSIL, Carlisle.

Thanks for your kindly criticisms. It is quite impossible to deal with every branch of field work in a single issue, but articles on Geology and other subjects not yet dealt with will appear in due course. The Botanical side of the F. N. Q. will also be more developed soon, and several other of the suggestions you make are also under consideration; but you must remember that it takes some time to cover all the subjects. Special Archæological subjects will be dealt with after the general articles, and illustrated. We shall always be glad to see original notes and observations, and publish them in so far as they are suitable to the character of this journal.

FLORIST, Tunbridge.

See Percival's 'Agricultural Botany,' p. 287 *et seq.* It is there stated that "many examples are known where cross-fertilisation does take place between different species of plants, as, for example, between the raspberry and blackberry, wheat and rye," &c. The progeny of such crossing are termed hybrids. "The more nearly allied the species are, the more readily do they hybridise." These hybrids are usually less fertile than their parents, often quite sterile. Doubling of the flowers is common in hybrids. In the later generations entirely new characters may be observed.

S. L. G., Wilts.

The Tawny Owl is a resident over the greater part of Great Britain. It has no ear tufts. Mr Witherby recorded a case in 'Knowledge,' June 1897, of a tawny owl killing a full-grown rabbit.

D. P., Co. Cavan.

The Nuthatch is very rare in Scotland, and does not occur, to our knowledge, in Ireland. Eggs from 5 to 8 in number.

R. P. H., Torquay.

The tusks of the elephant are incisor teeth. The molar teeth of *Elephas* are so large that the jaws cannot accommodate more than two and a part of a third at one time (Beddard's 'Mammalia,' p. 219). The African elephant uses the tusks for digging up roots, especially, so it is said, the right tusk, which is therefore frequently shorter than the left. The tusk of the walrus is a canine tooth.

TAXIDERMIST, Liverpool.

We do not recommend individual firms. Consult the advertisement columns of this and other natural science journals.

Young Naturalist's Quarterly Competition.

IN order to encourage the study of natural history and other scientific subjects, the Editor offers prizes every quarter for the best essays sent to him on the prescribed subjects. The competitions are open to all young students and scholars, and are specially intended for the pupils of public schools, colleges, &c., which have natural history and other societies for their scholars. Competitors must send their essays in their own handwriting, together with a statement from their head-master or clergyman certifying the essay to be the original and unaided work of a competitor under nineteen years of age. Essays should not exceed 1000 words, but may be as short as desired. In awarding the prizes, the Editor, whose decision is final, will take into account both the accuracy of the matter and its arrangement. The result of the competitions will be announced in the following quarter's issue. The successful competitor must then select his or her prize from those offered, and inform the Editor at once where the prize is to be sent to.

The Editor reserves the right to publish any of the essays sent in.

Note.—The subject for the next quarterly competition is, **"How British Birds provide for their Young Ones."**

Competing essays (with statement of age and originality) must reach the Editor of the 'Field Naturalist's Quarterly,' 17 Hartington Place, Edinburgh, on or before 1st October 1902. Envelopes to be marked "Competition Essay." The prizes will be announced in the next issue of this journal. First prize, any three of following books. Other prizes may be given.

Types of British Animals (Aflalo).
British Vertebrates (Aflalo).
A Walk through Zoological Gardens (Aflalo).
A Year with Nature (Westell).
Fauna of Shropshire (Forrest).
British Serpents (Leighton).
The Country Month by Month (Owen and Boulger).
Norfolk Broads and Rivers (Davies).
Design in Nature's Story (Kidd).
One Thousand Objects for the Microscope (Cooke).
Animal Coloration (Beddard).
To-day with Nature (Robinson).
The Vivarium (Bateman).
&c., &c., &c.

The Prize for the best Essay on "Our Spring Bird Visitors: Where they come from, and why do they come?" has been awarded to C. E. Raven, Uppingham School, to whom the prize will be sent on choice of books being received.

Notices.

To Contributors and Correspondents.

All articles and other communications (typewritten if possible) intended for publication, and all books, Transactions, papers, &c., for review or other notice, should be sent to the Editor, 'Field Naturalist's Quarterly,' 17 Hartington Place, Edinburgh.

Business communications should be addressed to the Manager at 45 George Street, Edinburgh.

Contributors are requested to write the department to which their communication refers (*e.g.*, Ornithology) on the envelope.

Every effort will be made to return unused communications where stamped addressed envelopes are enclosed for that purpose, but contributors are advised to keep copies of their MS., as the Editor cannot undertake responsibility for their non-return. Photographs or other illustrations sent for publication must be original and the absolute property of the sender.

The full name and address of the sender must accompany every communication. Anonymous communications will not be noticed. Correspondence is invited on all matters of general interest which fall within the scope of work usually done by field clubs and kindred societies. Original observations on the habits of living animals and plants will be specially welcomed.

The 'Field Naturalist's Quarterly' will be issued in February, May, August, and November; and all communications for the ensuing issue should reach the Editor at least one month in advance.

To Subscribers.

The annual subscription to the 'Field Naturalist's Quarterly' is 10s. post free. Single issues 2s. 6d. each. Subscriptions, which may begin with any issue, should be sent to the Manager, 'Field Naturalist's Quarterly,' 45 George Street, Edinburgh.

The 'Field Naturalist's Quarterly' may be ordered direct from the publishers, Messrs Blackwood & Sons, or through any bookseller or newsagent.

Copies of Nos. 1 and 2 of the 'Field Naturalist's Quarterly' can still be obtained by new subscribers who wish to have the volume complete.

To Advertisers.

Applications for terms and spaces to be sent to the Manager, 'Field Naturalist's Quarterly,' 45 George Street, Edinburgh.

Special terms for selected places, or a series of (changeable) advertisements.

The Editor begs to acknowledge the receipt of the following books, papers, &c. :—

Mammalia, Cambridge Natural History, vol. x. (Macmillan & Co.) By Frank E. Beddard, F.R.S.

Bird-Hunting on the White Nile ('Knowledge' Office). By Harry F. Witherby, F.Z.S.

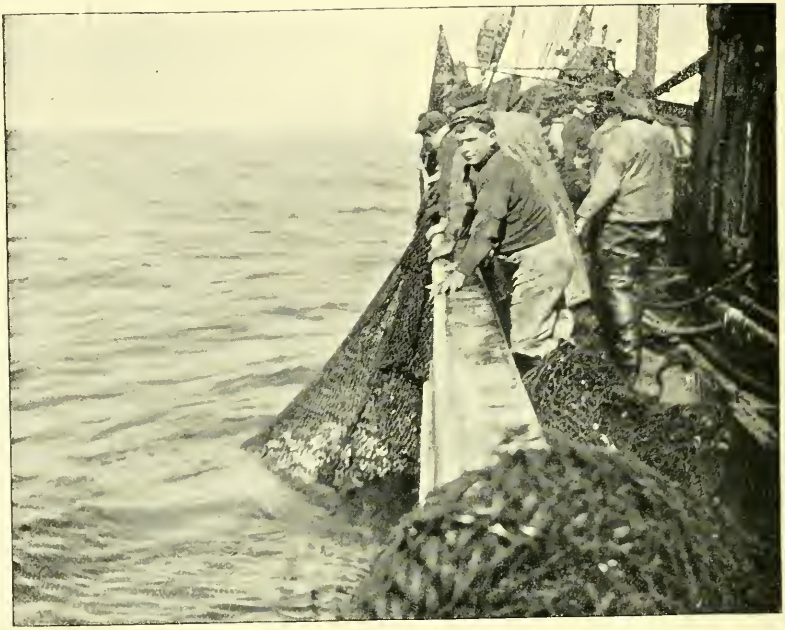
The Watkins Manual of Photography (Houghton & Son). By Alfred Watkins.

A Treatise on the Birds of Gloucestershire (Bellows). By W. L. Mellersh, M.A.
The Naturalist on the Thames (Seeley & Co.) By C. Cornish, F.Z.S.
First Studies of Plant Life (Ginn & Co.) By G. F. Atkinson, Ph.B.
Nature Study and Life (Ginn & Co.) By C. F. Hodge, Ph.D.
Invertebrate Zoology (Ginn & Co.) By H. S. Pratt, Ph.D.
Secrets of the Woods (Ginn & Co.) By W. J. Long.
Stars in Song and Legend (Ginn & Co.) By J. G. Porter, Ph.D.
Elementary Physical Geography (Ginn & Co.) By W. M. Davis.
Physical Geography (Ginn & Co.) By W. M. Davis.
The Face of Nature (Murray). By Rev. C. T. Ovenden, D.D.
Agricultural Botany (Duckworth & Co.) By John Percival, M.A.
A Handbook of British Butterflies (Simpkin, Marshall, Hamilton, Kent, & Co.) By J. R. Charnley, F.E.S.
Catalogue of New York Reptiles and Batrachians. By Edwin C. Eckel and Frederick C. Paulmier, Ph.D.
Catalogue of Minerals, Passmore Edwards Museum. By H. Auden, D.Sc.
Trees in Prose and Poetry (Ginn & Co.) By Stone and Fickett.
Wild Bird Protection and Nesting-Boxes (Taylor Brothers). By J. R. B. Masefield.
A Month on The Eddystone (from the 'Ibis,' April 1902). By W. Eagle Clarke.
The Early Life of the Young Cuckoo (Burleigh). By Percival Westell.
Exposure Notes (5th edition). Alfred Watkins.

The following periodicals and reports of societies have been received :—

Knowledge—June, July, August.
The Naturalist—June, July, August.
The Derbyshire Naturalists' Quarterly, vol. ii., Nos. 1 to 4.
The Naturalists' Journal—June, July, August.
The Ruskin School-Home Magazine.
The Essex Naturalist, vol. xii., Nos. 7 to 12.
Annual Report of Council of Zoological Society, London.
Annual Report, Wellington College Natural Science Society.
Annual Report, North Staffordshire Field Club.
Annual Report, Epsom College Natural History Society.
Annual Report, Northumberland Coast Club.
Annual Report, Society for the Protection of Birds.

PRINTED BY WILLIAM BLACKWOOD AND SONS.



The Haul Alongside.

Photo by A. E. Johnson.

Gutting the Fish.

Copyright F. N. Q

A FISHING TRIP TO ICELAND.

The Field Naturalist's Quarterly

Vol. I. NOVEMBER 1902. No. 4.

Editorials.

By the time that this autumn issue of the 'Field Naturalist's Quarterly' is in the hands of our readers, most clubs and societies will have held their annual meetings, and elected their office-bearers for another year. To those who have undertaken the management of such bodies we would offer our best wishes for success in their undertakings, and would venture to make some suggestions for their thoughtful consideration. We have had an extensive experience of field clubs in various parts of the country, and a still more extensive correspondence with their secretaries and members for some years past, and the result of that experience is to convince us that, in spite of the large amount of good work done by these bodies,—work which no one appreciates more than we do,—there is much room for improvement in certain directions. That this is the opinion of many of their members we have ample evidence of. It is not our intention to lay down a line of policy to be followed by all societies; different localities require varying lines of work, and this can best be determined by those on the spot. We simply wish to draw the attention of those who are responsible for mapping out the session's work to one point which our own experience and the statements of many correspondents prove to be much neglected.

It is our pleasing duty to read through the annual reports of most of the field clubs and societies in this country, especially in the cases of those which publish annual Transactions, and we have on a previous occasion referred to the vast amount of useful information that is to be found in these publications; and have, moreover, regretted that so much good work is thus locked up in local records, which would be of use and interest to the community. It is one of the aims of this journal to draw wider attention to such work, so that students of the same subject may see what is being done by others, and know where to find it. But there is one class of subject that, as a rule, one may look in vain for any recognition of, and one of the first importance. In a word, *general scientific principles* are usually untouched.

It may be said that the members of field clubs are familiar with the general scientific principles upon which the sciences they study are based. We should be glad to think that this was the case, but we fear that too frequently it is otherwise. A large proportion of the ranks of field naturalists are recruited from those who have had but little opportunity of learning the groundwork of the sciences,—and it is to their great credit that they do join such societies,—but the interest and profit they would obtain from those with whom they thus come in contact would be immensely increased if some effort were made to acquaint them with the natural laws which govern the details brought under their observation. We do not complain of the detailed work being done, —we welcome it,—but we should like to see it brought into focus, so to speak, for the benefit of those members who have never learnt the subject as a whole.

We have seen fifty members of a field club diligently collecting particular species of fossils on an excursion, and wondered how many of them had anything like a clear conception of modern geological thought. We have heard evening lectures to societies on rare varieties of this or that species of animal, and wondered how many of the audience had ever learnt the general principles of animal classification. At almost every meeting of a hard-working field club new records of some species of plant or insect are noted for some locality in which the species had hitherto been unobserved, but one searches in vain for any evidence that the members are instructed in the factors which govern animal distribution, or the spread of plants from their original floral limits to fresh localities. The microscope is brought to bear to display the marvels of pond life, but it is seldom that the field naturalist is made to realise that he is observing the first indications of the appearance of organised tissues for the performance of special functions. There is an abundance of investigation of plants and animals as *individual organisms*, there is very little attempt to teach the origin and history of *groups of similar* individuals by means of the great principle of natural selection.

If it be objected that the groundwork of the sciences can be learnt from books, we reply that though that is undoubtedly true, nevertheless the ordinary member of a field club is not, as a rule, a student of text-books. Those who are advanced specialists in some particular branch of field work can look after themselves, but a large proportion of people who join field clubs do so precisely because they cannot do this, either from lack of time or from want of previous teaching on scientific lines. It is on behalf of this class that we appeal to the heads of these institutions to endeavour to place before their members the general principles of the sciences with which their particular society deals.

That there is urgent need for improvement in field work on these lines there is no doubt, and in this journal we are attempting to help the field-worker in this direction. It has been a great encouragement to find our efforts have been already appreciated, and we have received many letters expressing the opinion of the writers that such articles are needed. We intend to follow up this line, and deal with such subjects as we have indicated above from time to time. But we should be glad indeed if we could convince secretaries of societies that they have a special duty in this direction; and if in drawing up their programme of subjects for the reading of winter papers they would give more time to the great principles of Biology, Geology, Archæology,

&c., and a little less to the investigation of minutiæ, we feel certain that they would earn the sincere gratitude of those in whose interest they have taken office.

Secretaries have sometimes told us that they can get papers or lectures only from those of their members who are specially interested in some original work, the results of which they wish to communicate. We can only say that in our opinion this is beginning at the wrong point. The field naturalist who would be a teacher to his fellow-members must first recognise that before he can expect his observations to be understood or appreciated, he must be quite sure that his hearers are familiar with the general principles by which he himself has been guided in his work, and with the most important facts which have been previously established.

* * * * *

In our next issue we hope to publish the first instalment of a new feature of the journal. We have for a long time felt the advisability of collecting together in one table all the most important and interesting records of species which have recently been recorded. At the present moment, if one wishes to ascertain how often and in what localities any rare species has been observed in 1902, it is necessary to search through the columns of some dozen or more papers to gain the information. In future that somewhat tedious process will be done by a good many willing helpers for the columns of this journal. The double advantage of this to our readers will be that not only will they find at one searching what records there have been in the quarter, but they will also see where these were published and the date, so that they can obtain for themselves the copy of the journal in which the record appeared and read the full account therein.

The information that our column will give will be simply the name of the species (scientific and common), the locality of observation, the date of observation, the observer's name, and the title of the journal to which the observation was sent or in which it appeared. For all other particulars readers must refer to the original source.

In addition to this, we shall include in this table all suitable records which come under our own notice from observation or from correspondents, and we have arranged a very simple method by which any one who is willing to assist in making the list as complete and universal as possible can do so. Forms to fill up will be sent to any one writing to the editor for them, and we hope ere long to get all secretaries of field clubs to report for their respective districts. Many have already promised to do so. If we obtain the co-operation of as many as we expect, it should be quite possible before long to have an observer in every county at least, and so to be fairly certain that no record of any importance will escape inclusion. We feel sure that such a feature will be of the greatest interest to readers, and of great service to both writers and students of field natural history. We shall be glad to hear from those willing to help.

* * * * *

The Nature Study Exhibit held at the Outlook Tower, Edinburgh, in October, was a selection of material from the exhibition given in July at the Royal Botanic Gardens, London, and was brought together by Professors Geddes and Arthur Thomson. The Outlook Tower was certainly, by past work and associations, a suitable place for such an exhibit, but one would have been glad if the Education officials at the Chambers Street Museum had taken the opportunity to secure and show an even larger selection of exhibits on a branch of education so sadly neglected in Scotland.

The Outlook Tower exhibition was, however, very interesting as far as it went. There were mounted specimens, paintings, drawings, photographs, and graphic descriptions of animals, birds, trees, stones, flowers, rivers, and scenes, illustrative of work done in board schools, Church schools, normal schools, and private schools for children and young women.

One boy of seven sent in a "Science note-book" with drawings (!) of flasks, beakers, and retorts, but he would have been better employed had he spent the time at caligraphy. The work of board schools, so far as the pupils are concerned, was ordinary, and therefore of great value as a cue to elementary school teachers. The school journeys of some pupils of a London board school, illustrated by full-plate photographs done by a teacher, the gardening of pupils of a Wesleyan school, and the tracings of the sun's meridian on the 21st of each month for a year as drawn on the window-panes of a Welsh village school, were eloquent, though by no means solitary, examples of the splendid work done by some elementary schools south of the Tweed.

When we consider the work of the higher schools set before us in the form of Nature Study note-books, doubtless selected for their exceptional merit, we admit we are face to face with a species of note-taking which we have never seen equalled. Very striking, too, was the teaching apparatus made by Miss Von Wyss, in this instance illustrating Pond Life and Fungi. The Continental influence is here obvious.

The record of gardening work done by a Welsh school was admirable, and of great practical value to teachers intending to work or already working on similar lines.

The exhibit as a whole proved that the best pedagogical method is being employed—a co-ordination of the work of observation, comparison, deduction, and expression, both from the literary and the scientific view of the subject. Above everything there is telling evidence that the individuality of the teacher, and not the supply of money or apparatus (within reasonable limits), is the determining factor in the successful teaching of this subject.

We are of opinion that more might be done by the authorities of the large museums throughout the country to aid teachers and scholars, by drawing their attention to the exhibits to be looked at, and where they may be seen. The illustrated guide of the Leeds Museum authorities is an example of the help that could be given in this direction. We trust that exhibitions such as this will become more and more common in our towns: nothing could be better calculated to open the eyes of the general public to the great results that are to be obtained, and to encourage both pupils and teachers to persevere on the lines of true Nature Study.

Our Neglected Mammals.

By H. E. Forrest.

"'Tis true, 'tis pity; and pity 'tis 'tis true" that in most Field Clubs, whilst the votaries of bird and flower lore abound, those who devote themselves to the study of our insular mammals are few indeed. For some occult reason the subject is avoided. That it is a legitimate part of a Field Club's work no one will deny. Why is it, then, that —with a few honourable exceptions—this particular branch has been so generally neglected? I have met with men, keen ornithologists, who, when asked to help in collecting information as to the local mammals and reptiles, have refused on the ground that they were interested only in birds, and there seems to be an idea prevalent amongst naturalists that our mammals are "Not Worth While."

It may be useful to inquire (1) how this idea originated, and (2) whether it is well-founded.

1. The probable origin of the idea may be found in the common knowledge that, as regards number of species, our mammalian fauna is poor, and the list not likely to be added to. This last consideration would deter many from devoting attention to the group in question, for, whilst the bird-lover may hope at any moment to come across some rarity brought over by the stream of migration or stress of weather, the student of mammals or reptiles can hardly have any such expectations.

Again, it is tacitly assumed that our mammalian fauna is so well known that nothing is left for us latter-day naturalists to discover—a fatal objection, if true. This brings us to the consideration—

2. Whether the idea is well-founded. In the first place, it is doubtful whether many naturalists could say offhand how many species of mammals there are in Britain. It may perhaps surprise the majority to learn that the total is 70. Of these, 20 cetaceans and 6 seals are marine; the remaining 44 terrestrial. Are these 70 species of mammals

worth studying? Can we find out anything fresh about them? To both these questions I would emphatically answer, Yes; and would further impress upon Field Clubs that this is precisely the kind of work which they ought to do. Almost every such club includes at least one ornithologist, to whom I would say, Why not add to the study of birds the cult of our other vertebrates? This would in no way interfere with present pursuits, whilst it would accomplish much useful work in addition.

Suppose, for example, that to some village near the sea news comes one morning that a Whale has been stranded during the night. A reporter from the local newspaper goes down to look at it, and proceeds to send off a sensational paragraph to his office, in which the whale is described as a monster 50 or 100 feet long, according to the elasticity of the reporter's imagination. Never by any chance are details given by which the species can be determined. Consequently, when the fauna of that particular county comes to be written the unfortunate compiler can make no use of the record. How different would be the case if our hypothetical naturalist was to the fore. Directly he heard of the occurrence off he would go armed with measuring-tape, notebook, and camera, and on arrival at the spot he would carefully note form, size, colour, sex, nature and number of teeth, date, wind, weather, and any particulars obtainable from the local fishermen, especially as to whether the whale was solitary or accompanied by others larger or smaller. These details he would embody in a report and despatch to the secretary or recorder of his club, to be preserved in the archives for all time—a permanent and valuable record.

As another illustration take the case of a terrestrial species such as the pretty little Harvest Mouse.[1] The existing records of occurrences are very meagre, yet, since they are scattered over a wide area, there is little doubt that the mouse and nest would be discovered, if sought for, in the intermediate country, especially if a small reward were offered to men engaged in harvesting operations. Indeed there are several species of British mammals whose distribution is as yet unascertained, and it is gradually becoming evident that certain animals reputed rare or local are actually abundant and widely distributed. The Whiskered Bat and Bank Vole are instances.

---

[1] Discretion is needed in accepting statements from farm-labourers, who commonly speak of the Field Vole or Short-tailed Field Mouse as the Harvest Mouse.

Owing to lack of interest in years gone by, certain animals have vanished from entire districts without any authentic record of their having ever existed therein. At one time the Black Rat and Roe Deer were probably found all over these islands, and they still occur in certain districts, yet in places whence they have vanished it is exceedingly difficult to obtain reliable evidence of their former status, or to find out, even approximately, the date of final disappearance.

Up to this point we have concerned ourselves mainly with matters bearing on geographical distribution, and it would be easy to show how much has yet to be done in this important branch of science; but enough has been said to prove the point, so we will pass on to consider whether there is still scope for work on purely zoological lines: Can we find out anything fresh about our mammals? If proof were wanted that original work could still be done in studying the habits of our mammals I would refer to Mr Charles Oldham's observations on the use of the tail-pouch in Bats, published in the two last volumes of the '*Zoologist*.' These constitute a valuable addition to our knowledge of these obscure creatures. Up to the present most naturalists have been content to accept unquestioned all statements regarding our native bats made by our veteran zoologists wellnigh a century ago, though in certain details these have proved to be erroneous. It is positively astounding how little we really know as to the breeding of some of our commonest animals. For instance, authorities differ widely as to the number of young produced in one litter by the Common Hare,[1] and in many other species it is highly desirable that actual records should be collected so that reliable statistics may be compiled. In a previous paper[2] I have shown that the Dormouse litters in the autumn, though British authors state that it breeds only in spring.

---

[1] *Vide* the 'Field,' 6th September 1902.

[2] F. N. Q., No. 1, p. 24.

I have since heard of two nests containing young in June, so that the truth appears to be that the animal litters in this country from June to September, and probably breeds twice in the year. This last point, however, is not proved. It is quite possible that the late breeders are younger individuals than the others.

In writing as above, I do not for one moment wish to cavil at the pioneer work of our older zoologists, for whom I feel an almost filial regard, but it is certainly possible to carry respect for authority too far, and no amount of book-study can absolve us from the duty of *observing for ourselves.* In the majority of cases, naturally enough, our observations will only confirm the correctness of the accounts handed down by our predecessors, but here and there we may discover something new, or detect an error. Even though we may make no new discovery, nor detect any error, it is satisfactory to prove for ourselves the correctness of our accepted authorities, to say nothing of the knowledge gained in the process. The gain is great; the loss nothing. The ornithologist can study his favourite birds as much as ever, but his horizon is enlarged: he now notes with interest the creatures that scurry along the hedgerow, that burrow in the earth, that swim and dive in the sea or stream, and that fly abroad in the dusk when most birds have retired. Ay, and the more he studies them the more will his interest in them grow, and as first one and then another problem in their natural history presents itself, the difficulties of solution will brace him to further effort in their elucidation.

In conclusion, may I urge upon Field Clubs this very practical suggestion: That in every district where the whole vertebrate fauna has not yet been worked out, the local society shall forthwith undertake the work of compiling a detailed list of the Mammals, Birds, Reptiles, Amphibians, and Fishes.

Folk-lore.—I.

SHAGFOALS.

By W. H. BERNARD SAUNDERS.

I KNOW of no work by any naturalist, ancient or modern, which contains a description of the Shagfoal, and I think I am safe in asserting that he has never yet been figured. There is no museum in Europe that contains a specimen of him, and I am not aware that any geologist has discovered any trace of him. Dictionaries and encyclopædias may be searched, even for his name, but they will probably be searched in vain.

It is to some of the quaint old villages of Northamptonshire or Cambridgeshire that inquirers will have to go to find what a shagfoal is.

According to all that may be there learned of him, he is an extraordinary creature, for he varies in form and colour in each village. In the old-world village of Barnack in Northamptonshire, with its Saxon church-tower still remaining very much as it was when the King of Mercia and his Saxon ealdormen held their councils there, the shagfoal is a monster indeed. The villagers—not the rising generation perhaps—will tell of "the great spectral bear—the shagfoal." But not many miles away, in the little township of Thorney in Cambridgeshire, where the Duke of Bedford holds sway, the shagfoal is a spectre, "half a horse and half a dog." Which half is horse and which dog I am not able to state. In this case, as at Barnack, it is of huge dimensions. At another village, Ailesworth, not many miles from either of these places, the shagfoal has a very indistinct form, but is "large and has flaming eyes."

Let us look in at this old stone cottage in the village of Barnack, where resides the aged widow Goodwin, in her eighty-first year. She was born in the cottage next door, and her forebears for generations have lived in Barnack. She has many tales to tell of the shagfoal, and she knows many people, some of them her own relations, who have seen the spectre. No, it is not white, she says; but has the appearance of a huge animal, generally supposed to resemble a bear.

Ask the aged wheelwright at Thorney, Henry Whittam in his seventy-fifth year, and he will curdle your blood with stories of the shagfoal. In some villages the shagfoal may be seen in the cow-pastures, in the hills, even in the village streets, but at Thorney he is only seen beside the thicket on the Wisbech road.

It is not for me to examine too critically this piece of Midland folk-lore which has come down to the twentieth century through many ages. The working folk-lorist, like the field naturalist, records things as he finds them, and generally leaves to others the task of drawing parallels or critically examining the origin or meaning of the legends and lore he discovers. Whether the shagfoal is a survival of Norse, or Scandinavian, or Saxon, or some other legend, is a question for scientific folk-lorists to discuss, as also the further question, when the origin has been determined, what light it throws on the history of this country and people. But in the meantime — board schools and certificated teachers notwithstanding—the legend still holds a place in the minds of many of the residents in the districts referred to—ay, even amongst those who, while affecting to disbelieve in him, have yet had his deeds or misdeeds so dinned into them from infancy that they cannot quite shake him off. Not that I can discover that he ever did any harm to anybody—or good either. He is feared perhaps for what he may do.

But the shagfoal is not a common object, he is only seen at rare intervals. At Thorney he is never seen in any other month of the year but August, and he is then very particular about the time of day or night that he discloses himself, being content to take his walks abroad in the dusk of the evening. Like all whose deeds are evil, he disdains light; but he also disdains the dark, and limits his manifestations to between lights.

This question of time may be significant, for it might be contended, after all, that the shagfoal is but a question of certain atmospheric conditions, and that he is merely a reflected image—perhaps distorted and magnified—of some existing object. But it seems a cold thing to try and rob these old-time legends of their weirdly character.

The old Thorney wheelwright's son, a man who reads a good deal and takes an interest in his surroundings, and who does not believe in the shagfoal as his forefathers believed in him, told me that he had himself seen the shagfoal. "One evening," he said, "as it was growing dusk I was walking down the Green Drove, which is not far from the Spinney on the Wisbech road, when a friend who was with me suddenly stopped and exclaimed, 'What is that on the road?' I could see nothing. 'Now it comes this way,' he added, and I then saw a strange white object on the left-hand side of the road. We both stood still, and when it came nearly level with us, the spectre—for so I will call it—turned to cross the road. It was very large, very white, and came as close to me as I am to you now. It seemed as if it would fall upon us as it passed. It possessed four legs, like those of a horse, but for the rest I can say nothing. It passed down to the water in the fen dike on the opposite side of the road. Almost at the same instant my friend and I were at the water-edge, but the spectre had vanished. It appeared to pass into the water. Many years ago a man and horse were drowned in the same fen dike and at the same spot."

I have frequently heard country people speak of spectres being seen in the dusk of summer evenings, and I have observed that there is water not far away.

An amusing story is told about the Thorney shagfoal. Several men were coming home from the fields one August evening when the shagfoal became the subject of conversation. One of the young men audaciously declared that he did not believe in the existence of the shagfoal, and said he would go into the thicket and challenge the monster to appear. His companions dared him to do it. He climbed the fence, entered the enclosure, and shouted his defiance to the spectre to come forth. To his horror, and the terror of those on the road, a deep sepulchral voice responded from the heart of the thicket, "I am coming." The challenger fled, and, pale and trembling, rejoined his companions, who stood awaiting his return. They had heard the rejoinder to the bold defiance, and were in alarm, wondering what evil the temerity of their companion might have brought upon them. To the relief of the group, and especially of him who had braved the shagfoal in his lair, nothing more formidable than a neighbour emerged from the thicket. He had been coming through it as a short cut home, and hearing the challenge had responded in what he conceived to be suitable accents.

How widely distributed the shagfoal may be in other parts of England I do not know; I only know him as I have found him in Northamptonshire and Cambridgeshire.

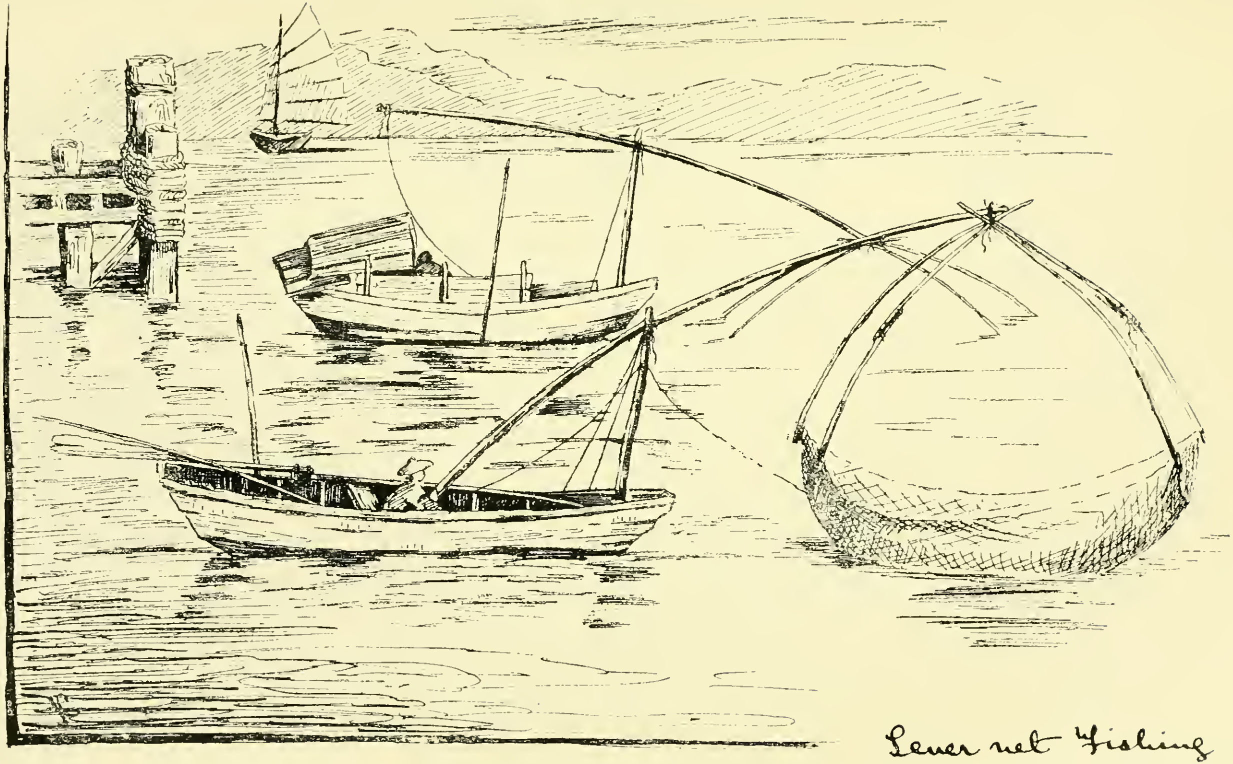
Fishing Notes in South China.

By J. C. Kershaw, F.E.S.

Many of the native methods of fishing practised in China are curious and interesting to a Westerner, some of them, like many other native functions, requiring a maximum quantity of noise and din, chiefly extracted from drums.

One peculiar industry is that of moonlight fishing with white-painted boards. Long narrow boats, reminding one very much of a sheep-feeding trough, with the usual bamboo and mat roof at the stern, the fishermen balanced by a large stone in the prow, paddle out from the shore on moonlight nights provided with broad white-painted boards the length of the boat, secured alongside and sloping up towards the gunwale but with the outer edge resting in the water. The white surface attracts many fish, large and small, which leap on the board or into the boat as the fisherman paddles silently along.

Of what may be termed lever-net fishing there are endless modifications ingeniously fashioned to suit different circumstances. The most common type is the square net attached at the corners to four bamboos, lashed together at the top, and raised and lowered by a pole pivoted to an upright post



Lever net Fishing

Drawn by J. C. Kershaw.

CHINESE FISHING METHODS.

fixed in a boat or "sampan," which is used in shallow water, the net resting on the bottom. If used from the shore the end of the pole is placed against a wall or heavy boulder, and the apparatus pulled up and down by a cord, the upright post being dispensed with. This net the fisherman raises every minute or two, and when perchance he catches a few miserable fry hardly bigger than minnows, he scoops them out with a small landing-net.

One may see these nets being used in a harbour amongst a crowd of boats, where there is hardly room to swing a cat, the fisher being surrounded and encouraged in his toil by an interesting crowd of coolies, loafers, and small boys. This he enjoys, and the louder the shouting, and the more the mud and water is stirred up by the boat-people with their bamboo poles, the more fish he seems to get. A modified form of this net, but smaller, is used in padi-fields and ponds for taking cat-fish and the Chinese edible frog, much as a shrimping-net is used at home.

The same style of net, but very much larger, mounted on four poles secured by stays from falling sideways, and raised by a windlass, is also used in shallow water, either from the shore or from a rickety structure composed of a few bamboos lashed together, which serves to support the windlass and forms a foothold and seat for the operator. Generally these nets are set up in gangs of three or more, sometimes, where the sea is very shallow, three or more miles from the shore, a boat visiting them in turn.

There is an opening or bag provided in the bottom of the net, the mouth of which is tied with a string, from which the fish are emptied into the boat. This is taken right under the net, the fishermen being practically nude, or wearing their palm-leaf rain-coats. These big nets are wound up at short intervals, the man at the windlass using his hands and feet alternately on the machine. When the net is lowered nothing is to be seen of it as it lies on the bottom.

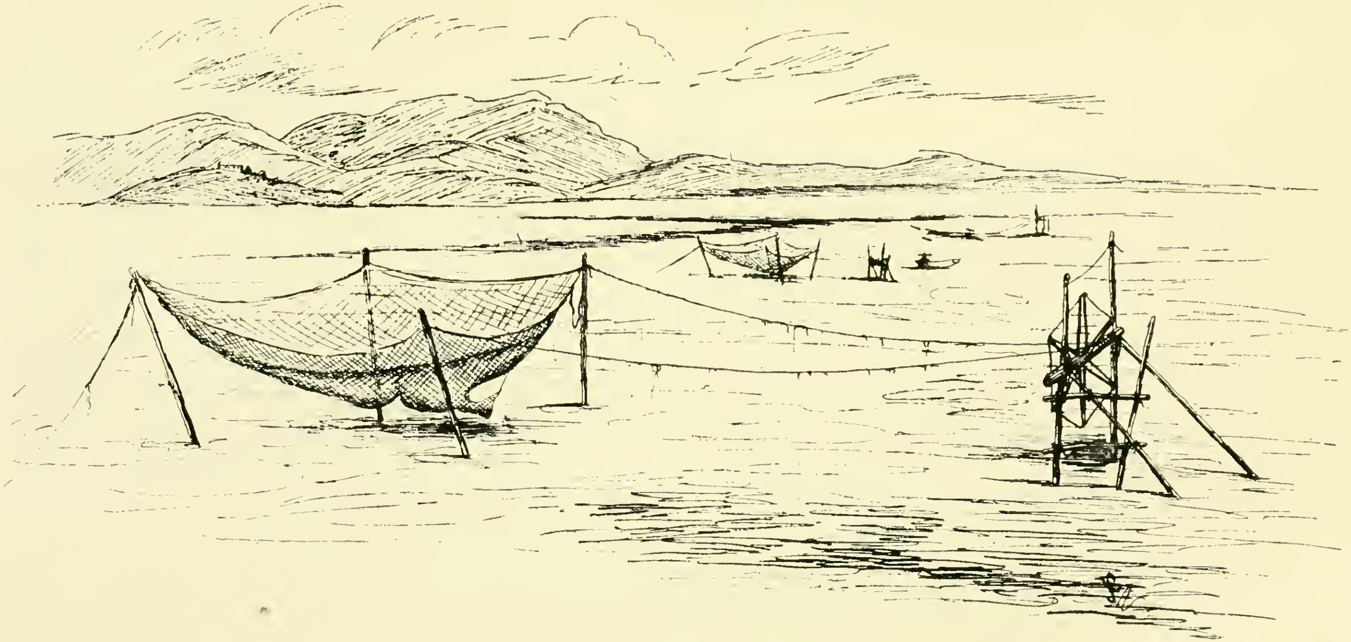
The fish taken are generally very small, and there is great excitement over anything much exceeding a pound in weight. Nothing escapes the native fisher; everything down to the size of a rather small minnow is "saved," and the wonder is that the fish are not exterminated.

Sometimes two boats will row out with a shallow net several hundred yards in length with floats attached, and gradually approach each other, forming the net into a semicircle, a third boat with men armed with drums and bamboos scouring the neighbourhood and scaring the fish towards the net by thumping the drums and beating the water with poles as the net is gradually hauled into one of the boats.

Whilst out one day in a Chinese steam-launch, not far from land, after an hour or more steaming hard we seemed if anything to move backwards, and I suggested to the "captain" that perhaps the screw had fallen off or some other little mishap occurred. He seemed struck with the idea, and diving off the stern, found one of these nets embracing the screw, twisted into a ball which had to be cut away piecemeal. Three or four fine fish were taken from it, alive, and the delighted crew dined luxuriously, whilst the launch prudently cleared from the scene before the owners of the net arrived.

Pink or flesh-coloured porpoises, which of course are fish as far as the natives are concerned, are not rare off the coast of South China, and should a junk see one of them crossing her bows, she will alter her course, as the Chinese think it is unlucky or "bad joss" to cross the path of one of these beasts, though should one happen to get into trouble in shallow water with a falling tide, they have no scruples about killing and cutting it up. The pink porpoise is supposed to be the abode of spirits of drowned seamen.

The larger fish are taken by the sea-going junks, but there is nothing remarkable in the means or appliances used, which are akin to Western methods. The fish themselves, however, are many of them extraordinary in size, shape, and colour, and it is worth while taking a stroll through a Chinese fish-market, in spite of the filth and stench which, whether in the form of the incense of joss-sticks or the emanations from the buckets of human ordure used for watering vegetable-gardens, seem inseparable from things Chinese.



Drawn by J. C. Kershaw.

CHINESE FISHING METHODS.

Reptile Studies.

By Gerald Leighton, M.D.

V. The Adder-Swallowing Theory.

It seems utterly impossible for the season of autumn to come and go without the question of whether or not the adder-mother swallows her young in times of danger cropping up for discussion in the press. This season has been no exception to the rule, and the usual statements have appeared from persons claiming to have been eyewitnesses of this extraordinary phenomenon.[1] There is no necessity to quote these references in full: they do not differ in any material manner from the usual statements which are seen from time to time in almost every periodical in the country. But in one respect this autumn is exceptional in this matter, inasmuch as a certain Mr Wilkins of Pembrokeshire claimed the reward of £5 offered by the 'Field' for any specimen sent to them containing the young adders in a position proving that they had been swallowed. It appears also that "Brusher" Mills, the famous adder-catcher of the New Forest, claimed the reward, and that he too forwarded an adder for dissection, which was duly examined, and reported on by Mr W. B. Tegetmeier in the 'Field.' The results of both these dissections were published in the issue of that paper of August 30, 1902, and the young contained in the adders were proved to have been unborn. That is to say, people who are not acquainted with the fact that the adder brings forth her young alive and fully developed, on finding specimens apparently with young inside, assume that they must have been swallowed. This is doubtless the origin of most of these cases of alleged observation. As we dealt fully with the process of reproduction in its later stages in our last issue, there is no occasion to repeat now what was then said: indeed it is only because the reports of the two above-mentioned cases in the 'Field' have brought us so many letters asking for information on some points not then dealt with, that we return to the subject now.

---

[1] *Vide* 'Oban Times,' August 23; 'Daily News,' September 8, &c.

The report on the specimen sent by Mr Wilkins is not signed, but states that some adders had been taken to the College of Surgeons to be opened by the Curator: presumably this was one of them, though the report is not quite definite on this point. No young ones were found in the gullet, but the report makes use of an expression which has puzzled some of our correspondents who are not comparative anatomists. The portion referred to is as follows: "The egg which was opened contained, as is invariably the case, a large amount of *opaque albumen* and a fully developed young viper. All the other three were in precisely the same condition. The stomach is situated nearer the head than *the ovary* which contains these eggs, and has no direct communication with it." We have italicised the words which have given rise to the difficulty in the minds of our own correspondents. Curiously enough, Mr Tegetmeier's report on the other dissection contains similar expressions in the same connection; and in order that there can be no question about it, we quote his letter in full. It is as follows:—

SIR,—To-day I have received from Mr Frohawk a letter enclosing a communication from Mr Short, of Lyndhurst, informing him that Brusher Mills has forwarded another viper with young inside, and he states that "Brusher thinks he is entitled to the reward, which would be of great service to him now." This specimen, enclosed in a tin box, Mr Frohawk has forwarded to me for examination. On opening the box I found a full-grown viper and three young ones, which were tied together with string, having obviously been caught with the mother. The three young, which had obviously been born in the usual way, were 5 inches in length. The parent was carefully killed by me by division of the vertebræ near the head. On being opened, the œsophagus, some 9 inches in length, was found perfectly empty, and contained no trace of food. The ovary contained five eggs, each enclosed in a very thin membrane. Each egg contained a full-grown young viper, 5 inches in length, coiled up into a compact form, and a considerable quantity of white opaque albumen. The young were all perfectly mature, and would have been expelled immediately had the animal been put into the warm sun. The viper certainly contained five living young, but they had not yet been born.

Of course, such specimens can in no way be entitled to a reward; there must be thousands of them to be obtained at the present time. The vipers are seen lying usually on a sunny bank, bringing forth their perfectly mature young, which immediately retreat in the herbage from the observation of observers, who imagine that they go down the throat.

The dissection of any of these reptiles will prove that there are no young in the throat or gullet of the animal, but that there are a number of eggs in the lower part of the body, in the ovary, ready to be laid. I am perfectly aware that it is a hopeless task to convince superficial observers, who have seen young vipers disappear on their approach, that they have not gone down the throat of the mother; but as no one has yet produced any valid testimony that vipers swallow their young, we may regard the whole matter as being one of the vulgar errors of natural history. The mere dissection of a viper and the examination of the structure of the œsophagus and the stomach, which is 10 inches from its mouth, would disprove to any one possessed of the slightest anatomical knowledge the possibility of the creature swallowing a number of its young, to say nothing of their returning again from the mouth of the parent.
W. B. TEGETMEIER.

It will be observed that in both reports the young are stated to be fully developed, to be surrounded by a considerable quantity of opaque albumen, and that the eggs were found in *the ovary*. Any one possessed of the most elementary knowledge of the process of development knows that such a condition of things is absolutely impossible, and we can only assume that the wording of the report is due to careless diction, and that the writer assumed that the readers would know no better than to believe it. But many people study natural history nowadays, and every student who has attended an elementary course of Zoology is aware that fully developed embryos are never found in an ovary. The physiological function of the ovary is to carry the eggs until they are ready to be fertilised. The eggs are then discharged from the ovary, which takes no further part in their development. At this stage the eggs are of course very small. The remaining stages of development in the adder consist in the eggs finding their way into a long tube, called by anatomists the oviduct, which leads from the neighbourhood of the ovary to the posterior opening. In this tube fertilisation takes place, and the further stages of development occur. There are of course two ovaries, a right and a left; and two oviducts corresponding to them. It frequently happens in the adder that developing eggs are found in only one oviduct; in my own experience I have found that when this is the case it is the right more often than the left which contains the eggs. In the above reports, where the "ovary" must be taken to mean the oviduct, it is not stated on which side of the body the eggs were found. While in the oviduct, the developing embryo becomes surrounded by a large quantity of yolk, on which material it depends for its growth. This amount gradually diminishes as the young adder gets nearer its time of birth, until *at full time there is none left.* If any large quantity of food-material is found in a developing egg, it is a sure sign that full time has not been reached. In this respect the eggs of the adder resemble those of birds; but in birds, in addition to the yolk, there is outside that a covering of albumen which serves as a buffer protecting the embryo from injury by movement of the egg. This is not found in adders' eggs. I hope my correspondents will be able to understand the above, which is as clear as I can make it without the use of technical terms. Their difficulty arose from the inaccurate use of the word "ovary."

On the final paragraph of Mr Tegetmeier's letter I do not propose to dwell. The statements contained therein are so sweeping that they lose the weight they might otherwise have. Any one who has dissected the gullet of an adder and found therein a field-mouse, or a water-vole, or other articles of diet, can see at once that there is no anatomical impossibility in the alleged occurrence, and of course when the entrance to the gullet is distended for the passage of any material, air must follow. Further, to kill an adder by trying to cut off its air-supply takes a very long time, much longer than one would suppose the adder-mother to retain her young if she did thus dispose of them. So it is that one finds frogs can survive in the gullet of the harmless ring-snake for, in some instances, twenty minutes, and be none the worse for their temporary incarceration.

The whole question of the adder-swallowing theory as it stands at present is one of impartially weighing the evidence for and against. If argument fails, there are those who in this matter fall back on abuse, which, to say the least of it, is rather unscientific. For ourselves, we have always maintained—in spite of misrepresentation in some quarters—that the question remains to be proved. The balance of evidence strikes us as tending to the negative, with some important exceptions, which have been discussed elsewhere.[1] It is very difficult, however, to lightly set aside such statements as that of Dr Dunstan in the 'Westminster Gazette' (October 1, 1901), who must be presumed to have some anatomical knowledge, and others of a similar character.

Of the possibility of the phenomenon we have not the slightest doubt, of the probability of it we have considerable doubt; but even a slight acquaintance with nature is sufficient to teach that some improbabilities are facts, and that things which at one time are regarded as impossibilities may in the light of fuller knowledge come to be matters of everyday occurrence.

It may well be asked by those who have no means of investigating the matter for themselves, but who carefully scrutinise the evidence printed on both sides, How is one to know what statements are to be absolutely rejected as unreliable, and what are worthy of consideration? The answer is, that any field naturalist who will take the trouble to make himself familiar with what is known of the structure and functions of the organs in the body of an animal will not have much difficulty in recognising palpable errors when he sees them. Also, he will be capable of recognising careful observation when it presents itself. For instance, many statements have been made by persons who assert that they have been witnesses of the adder-swallowing, in which the size of the young ones swallowed is put at about 3 inches.[2] Fully developed embryo adders measure from 5 to 8 inches long; as a rule, they are not less than 6 inches long at birth, frequently 7, and not rarely 7½ to 8. Therefore a statement which gives their length at 3 inches may at once be regarded as unreliable, probably the result of a hasty estimate at an exciting moment. Similarly, when two persons give diametrically opposed descriptions of the process, one saying that the young jumped into the mother's mouth, which was raised off the ground, the other that she put her mouth flat on the ground and the young wriggled in, one can only conclude that one or both were mistaken. The fact is that persons who are not trained to observing cannot describe the simplest processes with accuracy, and therefore their descriptions are worthless. It does not follow that what they attempt to describe never occurs, but it does follow that their accounts cannot be accepted. And when one finds persons who have some knowledge of comparative anatomy recording the finding of young adders 5 inches long in an ovary, we may well excuse the uneducated for similar loose statements. In both cases the event described may have occurred, but in neither case can the description be accepted as accurate.

---

[1] British Serpents, chap. xii.

[2] Ibid., chap. xiii.

The only scientific attitude to take up on questions of this sort which are unproved is to await events, and to carefully weigh such evidence as is forthcoming, whether that evidence is negative or affirmative. Dogmatic assertions, sweeping statements, or abuse of those who happen to differ from one, do not tend to advance knowledge.

VI. THE CAPACITY OF THE ADDER'S GULLET.

For some years past I have been hoping to obtain a specimen which would lend itself to illustration in such a way as to convey some adequate conception of the enormous capacity of the gullet in the adder. Up to the present season I had been unable to get exactly what I wanted, or if I did get a good specimen for this purpose, it was when I found myself in some lonely spot with no means of quickly preserving it *in situ*. I have frequently taken adders which were in process of feeding or had recently fed, and several photographs of adders thus engaged appear in 'British Serpents' (pp. 91, 89). But none of these show the capacity of the gullet, though they do illustrate the enormous power of distension possessed by the jaws. In the 'Zoologist' (September 1900) I published an illustration of the gullet artificially distended with air, which gives some idea of its dimensions; but it was not until August of this year that I obtained a specimen which was just what I wanted. Curiously enough, this came at the very time when considerable discussion was going on in the press on this precise point. When captured, it was obvious that there was some bulky material in the throat region, and this gave the adder a very distorted appearance. Fortunately I was able to dissect the reptile almost at once, and preserve it just as opened. Immediately afterwards I had the specimen photographed, and the result is reproduced on the next page.

The dissection simply consisted in fixing the adder down on a wooden dish on its back, and making a median incision along the belly over the region of the bulky contents. The two sides of the body wall were then turned outwards and fixed, thus exposing the gullet or œsophagus along its whole length. The state of affairs was quite evident without any further procedure, owing to the thinness of the gullet, which was tightly stretched over the mass inside. Unless one saw a specimen such as this, it would tax the credulity to believe how the gullet can be stretched without rupture. In order to display the contents still more distinctly, I made a longitudinal incision through the thin-walled gullet over the region of the head of the animal inside, and another incision over the region of the hind-legs. Thus clearly displayed, there was no difficulty in recognising the contents as a large specimen of the long-tailed field-mouse. The front legs of the animal were so clearly visible through the gullet wall that I did not expose them further.

If my readers will now look carefully at the illustration, they will, I think, be able to make out with ease the following points:—

Note first the light colour of the under-surface of the chin of the adder; the actual colour is reddish-yellow. This is a sexual colouration characteristic of females. In the male the scales in this region are generally black-edged or blackish all over. Then observe the mottled-grey appearance of the wide belly scales, also characteristic of the female, as opposed to the dark-bluish or black belly of the male. Next, occupying the lower half of the illustration, the mouse is seen within the gullet, the head appearing through the incision in the gullet. The two fore-limbs of the field-mouse can be distinctly made out through the tightly stretched gullet, and farther back—*i.e.*, towards the head of the adder—the hind-limbs and tail of the rodent appear through the other incision in the gullet. Careful observation will also reveal the teeth of the mouse, the mouth being open. At the lowest point of the photograph the gullet narrows, and opens into the small stomach, or, as it is more accurately called, the mid-gut. The walls of this organ are much thicker than those of the gullet, as can be seen, and as a matter of fact the mass of food does not enter this portion *as a whole*, but is digested as it passes in, a point I have repeatedly observed. The position of the field-mouse is the usual one: almost invariably these small rodents are swallowed head first—indeed I do not remember seeing a case in which the reverse obtained. Note, lastly, how the gullet at once is constricted over the tail of the mouse, showing its great elasticity. The general colour of this mouse is a light reddish-grey above and nearly white beneath, the hind-feet being long and white. These white characters can also be seen in the illustration.

The total length of this long-tailed field-mouse (*Mus sylvaticus*) Mr Forrest gives as about 8 inches ('Fauna of Shropshire,' p. 72), which closely corresponds with the dimensions of this particular specimen.

I need not point out the bearing of this adder and the contents of her gullet on the swallowing theory: it only proves the possibility of it from one point of view—viz., that of the capacity of the gullet to hold an average-sized family of young adders. Any one who has seen the small space occupied by the young in the egg-membrane just before birth, and the remarkable coil in which they are then disposed, will recognise that here is a case demanding an equal if not greater holding capacity on the part of the gullet. That, however, is only one of the difficulties of the question, and in no way affects the probabilities of the phenomenon, or the value of other evidence.

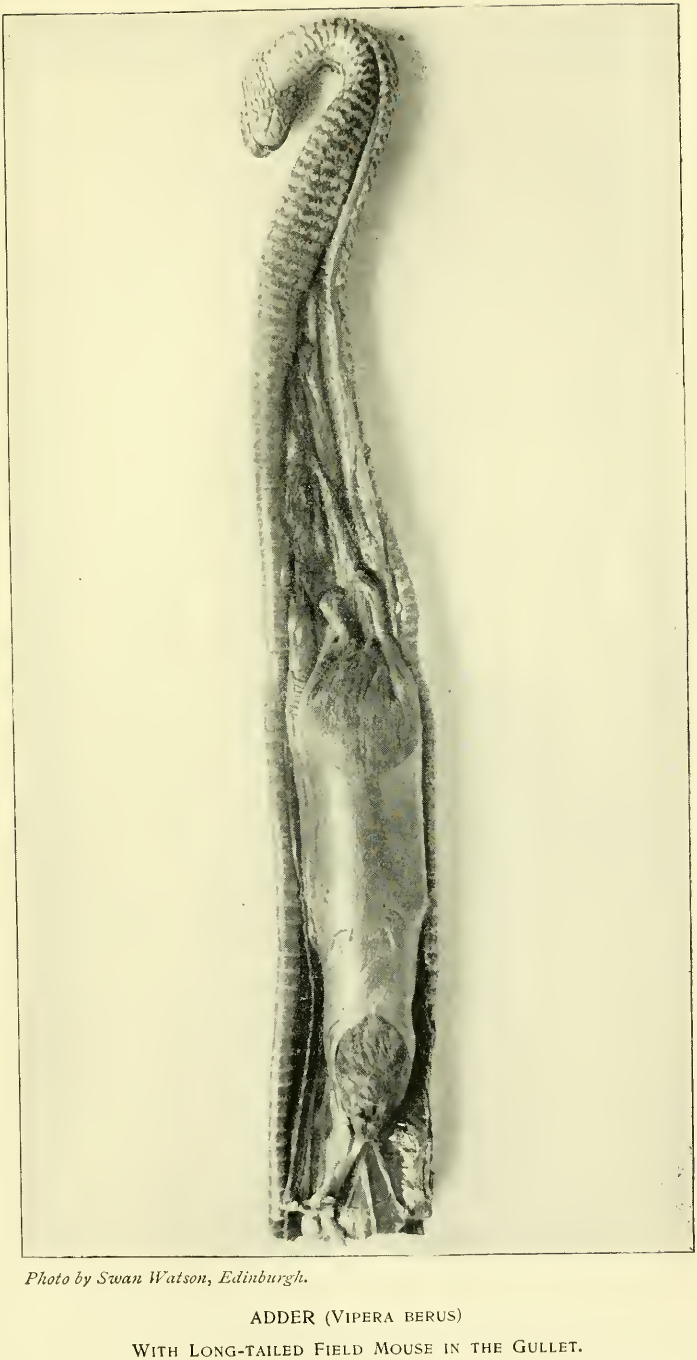


Photo by Swan Watson, Edinburgh.

ADDER (Vipera berus)

With Long-tailed Field Mouse in the Gullet.

I have only to add that the specimen here figured I have presented to the Zoological Museum in the University of Edinburgh, where it now is, exactly as seen in this photograph.

Some Autumn Wild Flowers.

By W. Percival Westell, M.B.O.U.

The field naturalist, like the sportsman, has his opening and closing days; he remembers when he bloodlessly stalked certain wild creatures, as the sportsman looks back upon some record, or rare, "bag." I have stated that the field naturalist has his closing days, but has he? From January 1 to December 31 has he any close season? Is he rather not constantly on the move throughout the whole 365 days of the year? When I write closing days, however, I mean to imply that the field naturalist has his busy season and his quiet season, and probably—if at all—the autumn may best be designated as the latter. Thus it comes about that the wild flowers of autumn do not produce much material for an essay, and yet when one rambles by the country-side in search of practical notes for the writing up of such an essay, the list of wild flowers found still blossoming may assume large proportions. But in this instance it is not my intention to bore the reader with a mere catalogue of wild flowers found in bloom during the autumn, nor to give a list of those flowers which may reasonably be looked for at that season, but rather to remark upon a few species which are generally found in flower during the autumn months. A great deal depends upon the season: an early frost or two soon cuts off a great many flowers which, try as they will, cannot revive sufficiently during the day to rear themselves, warmed though they may be by the autumn sunshine.

Although the thistles are mostly seeded and the parachute-like seed-heads may be seen floating through the air, a good many may still be observed in flower. The wealth of blossom is not nearly so gorgeous as in the prime of summer, but those that are in bloom are most welcome at this quiet season. Richard Jefferies loved the thistles. Partly because they flower right on to the autumn, and partly because of my admiration of the dear old Nature-lover, I love them too.

The smaller knapweed is another plant which flowers rather profusely during the season of which I write, and on a recent ramble it was interesting to notice that the humble-bees were to be seen on almost every other flower-head. The bees seem to be very partial to this flower at the autumn season. It is to be regretted that so fine a flower as the larger knapweed is not more abundant, but in some districts it may perchance be commoner than with us in Hertfordshire.

I know of no other wild flower of the colour of the harebell which still blooms in the autumn, and its delicate symmetry and chaste colouring lends an additional charm to the hedge-banks and commons where it flourishes; whilst the very dark purple of the peculiarly named devil's-bit scabious throws off very prominently a fine array of dark colouring to the ramble by the country-side.

St John's wort may still be found in bloom, though mostly seeded now, and other yellow or golden colours are supplied by the nipplewort, hedge-mustard, sow-thistle, hop trefoil, common avens, rock rose (a most frail plant, but sweetly coloured with lemon-yellow), charlock, agrimony, toadflax, long-rooted cat's-ear, and the dandelion. James Cundall calls the dandelion the sunflower of the spring: that it is an early and late blooming wild flower is known to most dwellers in the country. Its golden disc cannot possibly be overlooked, and really, when carefully examined, is a wonderful flower, but too little appreciated. The poet was no mean observer when he wrote—

"Richly embossed in silken grass
  The golden dandelion shines;
A sunflower in the early spring,
  And bright when summer eve declines."

Scentless May-weed still makes a brave show during the autumn; the little herb-robert struggles on until the first keen frost cuts it asunder; the white deadnettle flowers often throughout the winter if the season is an open one, a remark which also applies to the chickweed and the groundsel.

I write of common flowers,—I prefer it: common things are too often overlooked in these days; the cry seems to be for rarities and oddities. Richard Jefferies clamoured not for rarities, but for the old-loved birds, flowers, insects, fish, and other of the commoner forms of wild life, and I am a devout follower of that nature-soul.

Other white flowers which bloom at the season of which I write are the yarrow, cow-parsnip (mostly seeded, the large umbelliferous seed-heads being quite a feature of the countryside now), white campion (neither the pink nor the bladder species rarely seem to bloom late), wild carrot, and lesser stitchwort, which has a much longer flowering period than its greater relative.

Betony is frequently found in bloom during the autumn, knot-grass is at its flowering height at this season of the year, and perchance a scarlet poppy or the mauve of the field scabious lend additional colour to the scene.

Enchanter's nightshade still raises its delicate flowerets; the sweet sky-blue of the germander speedwell may often be seen, as well as red bartsia, burdock, and pink persicaria; whilst small willow herb, hedge stachys, and heart's-ease also flower on to the autumn, the last named in abundance.

On a recent autumn ramble, too, I found the exceedingly pretty gentian (*Gentiana amarella*) in flower, and also noticed the delicious pale blue of the succory, from the roots of which the chicory of commerce is obtained. A very large bed, too, of the eyebright was also observed, and was really one of the most delightful floral sights of autumn I have ever seen.

The star-shaped blossoms of the lowly blue sherardia may be seen as a result of a careful search, and the blue of the field scorpion-grass, the purple of the wild thyme, the pink of the crane's-bill, the greenish-yellow of the wood sage, and last, but not least, the welcome clematis-like blossoms of the traveller's joy.

Other species may perchance be found in flower during the autumn, but enough has been written already to show that, although—as compared with the wealth of spring and summer—this may be set out as the field naturalist's quiet season, the autumn flora supplies many an interesting study if practically pursued.

Norfolk Broads in Autumn.

By Rev. M. C. H. Bird, M.A., M.B.O.U.

So far as the bird-life of the district is concerned, the first conspicuous sign of coming autumn is discoverable in the great evening gatherings of Martins and Swallows upon the reeds. These twittering assemblies are composed of the first broods reared in every sand-pit and chimney-stack and under every roof-eave of the neighbourhood. Very different in behaviour at bedtime are these gentle birds to the quarrelsome Starlings, which, a month or two later, will resort to and replace the peaceable Swallows in this odd roosting site: odd, I say, for who with no previous experience of this habit would expect to find birds which everybody must be familiar with as breeding under cover, spending the cold night by the water-side? There is indeed more excuse for the Swallow tribe perching here than for the Starlings, for with the first morning light a plentiful breakfast will be at hand for them; whereas the latter birds do not find their first meal around the reed-beds, but, dividing into little companies, betake themselves on waking to the arable land and grazing marshes for miles around. There their presence will be welcomed by the observant agriculturist, for they are indefatigable in their search after wireworms—one of the most troublesome of farmers' foes, destructive alike to the roots of grasses, autumn-sown wheat and oats, and spring-sown barley and mangold. But the marshman objects to the Starlings spending the night on the reed, for the very good reason that by doing so they much reduce the value thereof for thatching purposes, breaking it greatly down by their weight and fightings for the most desirable perches. And the worst of it is, that they always select the best and tallest patch of reeds to roost upon first; and where, as here, the reed-beds are extensive, constant persecution is necessary to drive them away. When stress of weather compels them to seek the shelter of the woods at night-time, they show a decided preference for plantations containing large evergreens, such as laurels and rhododendrons; but there also their arrival is not appreciated. True, their aerial evolutions are marvellously beautiful to watch, and their incessant chatter is enlivening; but the stench of their excreta is considerable, and the shrubs and tree-tops are frequently killed by the continued presence of their thousands.

Next to the congregating of the Hirundines, the silence of the Sedge and Reed Warblers and the departure of the home-bred Pewits and Redshanks bespeak the waning of the year; and the arrival of a few weird-voiced Curlew or Whimbrel, a solitary Green Sandpiper, or a little trip of Golden Plover, are also unmistakable tokens of the approach of shorter days and longer nights, in which the Cockchafer, having given place to the more useful Dor Beetle (*Geotrupes stercorarius*), the Eels will begin to run down to the sea, and the Eel-setter's nets will be stretched to anticipate and prevent them. For some weeks the young male Robins—now arrayed in adult plumage—have been making subdued attempts at song, notes which harmonise well with the dull, still days so frequent in early autumn, when the gossamer webs, for want of a breeze to float them, bestrew the stubbles, and the reeds rustle not, nor does a ripple stir the placid bosom of the Broad, save where the shallowness of the water forces the dorsal and upper tail fins of a shoal of Bream to pierce, and in their movements to disturb, the otherwise unruffled surface of the clear water. It is at this season of the year that a few belated Swallows flicker low over the ollands, where the second-crop clover, though nightly fed by the cart-horses since haysel, is still in bloom, and still grows so thickly in places that we wonder how the ploughshares will be able to cover it up when the time soon comes for turning over the land in preparation for sowing the wheat. The present crop is that beloved of Landrails, for here they find their favourite food (*Tipulæ*) abundant. Here, too, when there are any in the neighbourhood, the Clouded Yellow Butterflies will most likely be found. That bare patch on your left was caused by the parasitic Dodder plant, which strangled and sapped the life of the clover; and a few yards in front is a now withered stem of the equally sycophant Broom-rape, whilst those white umbels scattered like stars all over the field are the blossom-heads of the Sea-carrot (*Daucus maritimus*), a common plant in the district, and proverbially "kind to wheat." The fleshy roots decaying in the soil provide perhaps a certain amount of nutriment for the following corn crop, and this has probably given the weed a good name amongst farmers. It is a near ally of the Marsh Fennel (*Peucedanum palustre*), the principal food-plant of one of our local rarities, the Swallow-tail Butterfly. In some seasons the clover-fields here absolutely swarm with Gamma moths, not necessarily natives, for these insects have been proved to migrate across the Channel. Clover is not grown for seed in Broadland, otherwise this would probably have proved a poor season for its development, since Humble-Bees, its chief fertilisers, have been remarkably scarce this year. The general rankness of our marsh vegetation may account for the infrequency with which the light of the Glow-worm is seen, but I have had many of the winged males come to lamp in my cabin-boat, and once when standing flight for Plover on the edge of E. Ruston Common I literally picked up handfuls of larvæ which were washed up amongst the *débris* of the first autumnal flood, and now regret that I did not ascertain by dissection whether the Pewits were feeding upon these illuminated morsels.

As early as September 5, 1902, six Pochards put in an appearance at Hickling, and we may soon expect to meet with the first Jack Snipe of the season. Our homebred Snipe depart early, and often by the first of August there are not so many old and young remaining with us as there were parent birds breeding in May.

If the waters be low and artificial feeding is not resorted to, the young Wild Duck leave their native haunts soon after they are able to fly strongly. In fact, far more flappers would be bagged in the neighbourhood if the close season ended a fortnight earlier, whilst on the other hand it would be for the benefit of the species if it commenced at least a fortnight sooner. I have, in two different years, seen young Wild Ducks swimming on March 28 and April 1, and this was long before semi-domesticated birds were anything like so common as at present, the turning down or escape of some of which has probably hastened the breeding period, and is accountable for the January eggs which we sometimes see chronicled in the papers; but however hard the weather may be, the local Wild Duck are generally paired by the first week in February.

In support of the contention that August the 1st is fully late to commence flapper-shooting let me quote a conversation I had some years ago with a man who had been making the feathers fly a week or two before the legitimate time. I approached his boat and asked him whether he was aware that he was breaking the law. On my telling him how, he replied, "Oh, that new law you mean; we don't take no account of that,—that was made for them West Country folk. If we don't get 'em [*i.e.*, the Ducks] directly they fly, we don't get 'em at all."

The first birds to move off after breeding are the Mistle-thrushes; they get together in little parties, and frequent the open fields and marshes for some weeks preparatory to their journey southwards. A more ubiquitous token of departing summer is the silence of the Cuckoos, especially abundant in the Broad district every year, and this year exceptionally late in ceasing to "sing." The young birds spend their last days with us on the seaside marshes, feeding meanwhile partly on the orange-and-black-banded larvæ of the Cinnabar Moth so plentiful on the golden bloomed Ragwort, one of the few weeds which the most prevalent Rabbits will not condescend to devour.

As autumn progresses, our special rarity, the Bearded Tit, is apparently seized with a mild form of the migration fever, for little parties—separate families, I believe—of this delicate bird may now be met with roving some distance from their actual breeding quarters. The multitude of troublesome Blackbirds and Thrushes having gleaned the now unnetted garden small fruits, and sampled the first windfalls of the early ripening apples, betake themselves for the most part to the glaucous swede-fields, especially umbrageous this autumn, and therefore perhaps all the more abounding in such slug, worm, and insect food as is beloved of the Merulidæ.

The naturalist patroniser of St Partridge day must perforce particularise upon the scarcity of Larks to be met with at this season of the year. The Sparrows have come from the towns and the villages and farmsteads, but the Larks have unobservedly departed from the cornlands, to be soon replaced in greater numbers by the representatives of a more northern and hardier race of these lofty songsters, whose arrival on our stubbles may be diurnally observed during the early part of October, just previous to the great influx of Continental Corvidæ, Snipes and Woodcock, Short-eared Owls and Golden-crested Wrens.

Following hard upon the incoming Larks, a Merlin or two may be looked for, and a few Widgeon may also be expected. Even the Great White Swan sometimes rears his stately head and "honks" upon our waters before the end of chill October. The truly wild Cygnus once previously identified may ever after be easily recognised at a distance from the Mute Swan, whilst settled, by the carriage of his head and neck. The latter is less arched than in the tame bird, and the beak is borne at right angles to his body. The smaller Bewicks keep much closer together on the water than the Hoopers, are a more lumpy, gooselike bird, and appear to be more sociable.

Here is a tale showing what arrival of autumnal migrants is, or at any rate used to be, most anxiously anticipated in Broadland. One Sunday afternoon during service a sporting squarson's serving-man rushed in his shirt-sleeves into church, waving his coat over his arms, and shouting, "They're come, sir! they're come!" meaning that the first whisp of foreign Snipe had settled upon the adjacent marshes! a proceeding less justifiable, if not less authentic, than the shouting of the names of the first three horses in the Derby of 1879 by a Cambridge undergraduate in the Senate-house during exam. time!

The subsequent behaviour of migrated Snipe, and the prospect of sport to be obtained amongst them, depends not so much upon their numbers as upon the state they find our marshes in. If the waters be high when they arrive they soon move on farther west or south, not to return until the end of the close season next spring. But if the marshes are in order and continue so, so long will the Snipe remain with us, unless a sudden frost compels them to seek a land of springs and running brooks, where the waters, having a greater fall than in our alluvial plain, do not so rapidly congeal. Every autumn we hear of a Rough-legged Buzzard or two being trapped or shot in the district. Whilst here they chiefly frequent the neighbourhood of the warrens between Sea Palling and Winterton, preying upon Water-Voles and weakly Rabbits, but they will sometimes turn their attention to wounded game, as I have had personal evidence of; for once on going to look for a pricked Cock Pheasant some half-hour after he had received his death-blow, I found him half plucked, and saw a Rough-legged Buzzard rise from him at my approach, and this in thick covert where the osiers were some 10 feet high. Upon another occasion I saw one of these birds strike at, but miss, a French Partridge whilst on the wing; but they generally take their prey from the ground, as does that arrant poacher but useful scavenger the Grey Crow, although when pressed by hunger they will chase and attack small birds on the wing. For instance, on March 4, 1890, I added at any rate a few moments to the life of a Thrush by striking at it with my driving-whip whilst it was being so closely and intently followed across the road by a Hoodie that neither pursuer nor pursued seemed aware of my proximity. I was driving in a high dog-cart at the time, but the roadside hedges were higher. On March 9, 1888, two Crows attacked a small Spaniel of mine whilst it was rolling in the snow on Brunstead Common, and made it cry out from fright or pain.

Thousands of Corvidæ, Grey Crows predominating, arrive upon our coast-line during October, and scatter themselves over the county; but the Broadland triangle seems to possess a special attraction for them, and judging from the regularity and familiarity with which three or four now annually visit my poultry-yard each morning at feeding-time, I think the same individuals return year by year to the same winter quarters as surely as the same Swallows and House-Martins revert to the same nests.

Having wandered in my chronology, let me relate an autumnal instance of the bold depredations of Grey Crow. In the last week of October 1884 my father and a friend were shooting a 14-acre marsh at Somerton. Ere commencing to do so the previously slaughtered game were deposited at the gateway; when they had finished beating the marsh, it was found that some Crows had completely spoiled a Hare and three Rabbits. A small piece of newspaper laid over the bag, or a spread-out handkerchief, would have been a sufficient protection, but this precaution had not been taken to scare away the suspicious though crafty Kentishmen. The *sobriquet* of "Danish" is intelligible, but why *Corvus cornix* should be hailed as a native of the hop county I have not been able to discover. They are certainly no more abundant at any season of the year in the proverbial garden of England than they are in the now far-famed Broadland district.

Some Birds in Shakspear.

By J. L. Bevir, M.A.

The Corvidæ.

Before actually turning to Shakspear I cannot refrain from saying a word or two with regard to the Latin and Greek names, their translation into English, and their use as terms in ornithology. There are two pairs of words—*κόραξ*, *corvus*, and *κορώνη*, *cornix:* the former is translated in lexicons and dictionaries as raven, the latter as crow. Now I admit that upon a good many occasions the ancients used the words loosely, just as one finds the French do not distinguish between *corneille* and *corbeau;* but in such cases as there is a distinction, I believe that *cornix* refers to the raven, and *corvus* to the crow or rook. I will quote but one case, for one has both a Latin and a Greek allusion to the same phenomena.

In the first Georgic, where Virgil is talking of signs of coming rain, he says in line 381—

"e pastu decedens agmine magno
Corvorum increpuit densis exercitus alis."

And again in 410—

"Tum liquidas corvi presso ter gutture voces
Aut quater ingeminant et sæpe cubilibus altis
Nescio qua præter solitum dulcedine læti
Inter se foliis strepitant."

Where could you find a better description of rooks going home and their chatter, as they crowd in the lofty rookery? While in the meantime in line 388 we have

"Tum cornix plena pluviam vocat improba voce
Et sola in sicca secum spatiatur arena,"

which may very well apply to a raven. The passage is an adaptation from the 'Diosemeion' of Aratus, and in that we have a further touch, for he says: "Thus indeed the families of rooks (*κόρακες*) and tribes of jackdaws appearing in packs and uttering sounds like hawks." The presence of jackdaws on the occasion precludes the possibility of *κόραξ* being a raven. Aratus was more of a naturalist than Virgil, for he goes on to distinguish between the birds that go in packs (*ἀγεληδὸν*) and the solitary bird (*ἐρημαῖος*) that says *Dissakis*.

But I have no right to be dabbling in the dead languages, and will proceed to deal with the Raven (*Corvus corax*). The bird gets a bad character from the theologian. His behaviour on being let out of the Ark was irritating, almost flippant, but one would have hoped that his feeding of Elijah might have compensated for it. But this is not so; when one looks into the Targum of the Old Testament, one finds that they are very severe on the Raven. They interpret Psalm clxvii., "He giveth to the beast his food, and to the young ravens which cry"; and again (Job xxxviii. 41), "Who provideth for the raven his food?

when his young ones cry unto God, they wander for lack of meat," to mean that the Raven deserts his young. This is very disgraceful on his part if it be true, but not more disgraceful than what many migratory birds do, if they happen to have a brood so late that they cannot join in the general migration. This is widely known to naturalists; but it is always well to produce one definite witness. I therefore quote from Mr F. M. Duncan's 'Feathered Travellers': "Directly the time arrives for birds to depart, the young that have hatched out late, and are not perhaps half fledged, are deserted by their parents and left to perish miserably from cold and starvation."

Shakspear was familiar with this view of the Raven's conduct, but attributes to it charitable feelings ("Titus Andronicus," i. 3)—

> "Some say that ravens foster forlorn children
> The whilst their own birds famish in their nest."

To the ordinary layman the Raven does not commend himself much more; his black shineless coat and his deep sepulchral voice have a depressing effect on one. I admit to having been deeply impressed when wandering alone in the garden in a small German inn, on suddenly hearing a deep voice call after me "Spitzbube." I looked round to see who could be thus insulting me, when the remark was repeated. I then saw a big black raven sitting on the wall, with his head on one side, apparently pleased with the effect he had produced. I do not think that any one has expressed one's feelings with regard to the bird better than the Shepherd in the 'Noctes':—

"A raven rugging at the bowels of a dead horse is naething, but ane sitting by himself on a rock in some lanely glen, and croak croaking, naebody can think why, noo looking savagely up at the sun, and noo tearing, no in hunger, for his crop is full of carrion, but in anger and rage, the moss aneath him with beak and tawlons; and though you shout at him wi' a' your micht, never steering a single fit frae his stane,—I say, sir, that sic a bird, wi' sic unaccountable conduct, in sic an inhuman solitude, is a frichtsome demon."

It is under this aspect, as a bird of ill-omen, that he frequently appears in Shakspear, who speaks of him as "the hateful raven—the fatal raven"—or in a more developed form ("Macbeth," i. 5)—

> "The raven itself is hoarse,
> That croaks the fatal entrance of Duncan
> Under my battlements."

Or, as one finds in "Hamlet," in the play scene (iv. 2), "The croaking raven doth bellow for revenge"; or again ("3 Henry VI.," v. 3), an interesting passage where Henry is talking of Richard, he says—

> "The owl shrieked at thy birth,
> The night crow cried, aboding luckless time,
> The raven rooked her, on the chimney-pot."

As to what the Raven did on this occasion there is a great division of heart. Dr Johnson, who has a way of stepping in where angels fear to tread, changes the text to "rocked her," which is an unlikely movement on the part of the Raven. I shall have occasion to speak later on the word "rooky." Some are inclined to connect the two words here, in which case it would mean, looked her blackest, as one finds in "Troilus and Cressida" (ii. 3), the Raven chides blackness. But I have no doubt that it simply means croaked, a view which is borne out by Skeat's derivation of the word rook as the croaking bird.[1]

There is another point about the Raven, that it rarely attacks living animals, though it is not so fond of putrescence as many birds. What it likes is a carcass from which the life has just gone out. In a little valley in Norway which I frequent I never saw a raven till this year, and then put up six, who were discussing a sheep that had lately died. As Canon Tristram describes, it will often watch a dying animal, and then experiment on it by digging out its eye. This habit Shakspear notices ("Othello," iv. 1)—

> "It comes o'er my memory as doth a raven o'er an infected house."

Or again ("K. John," iv. 3)—

> "Vast confusion waits,
> As doth a raven o'er a sick-fallen beast."

---

[1] Nares's Glossary gives rook or ruck, meaning to squat.

There is one more attribute of the Raven, he is an early riser, and for this Shakspear gives him credit ("Cymbeline," ii. 2):—

> "That dawning may bare the raven's eye."

With this I pass to Crows and Rooks—*Corvus corone*, the Carrion Crow; *Corvus cornix*, the Hooded Crow; *Corvus frugilegus*, the Rook. There are those who would put the Rook into a different category, but I follow Gould.

The most interesting allusion in Shakspear is in "Macbeth" (iii. 3), where he is meditating the murder of Banquo. He says—

> "Light thickens, and the crow
> Makes wing to the rooky wood."

I am quite sure that Halliwell's interpretation is right. In his archaic dictionary he says, "Rooky, roaky; hazy, misty" (Lincolnshire). It occurs twice in this sense in an old book, "Roky, misty, nebulosus." "Mysty or rooky as the eyre"; and he gives other quotations in support of it, mentioning this passage in particular. The word is now purely East Anglian. I remember many years ago in Suffolk an old man who described to me what happened in early spring by, "It snew, and it blew, and it thew, and then came a great roak" (my spelling is phonetic). Seeing that the word rooky is especially Lincolnshire, it is odd that Tennyson, evidently drawing on the lines of Shakspear, should have said in "Locksley Hall"—

> "The many-wintered crow
> That leads the clanging rookery home."

Some naturalists have been very much shocked by these lines, saying that he should have known better than to confuse the pious Rook and the unconscionable Crow. But the two classes do mix. Both Bewicke and Charles Dixon say of the Hooded Crow that it is more gregarious than its *confrère* the Carrion Crow, and when inland mixes freely with the Rook, while Hudson goes still farther and says of the Carrion Crow, "When not engaged in breeding the crow is to some extent gregarious, and is also social, associating both in the fields and at roosting-time with rooks and jackdaws. And it is probable that this habit may even have saved the species from extermination, for while among rooks he easily passed for a rook."

Apart from this quotation, the character which the Crow bears in Shakspear is no better than that of the Raven; he speaks of them as knavish and ribald, and alludes to his habit of eating dead bodies ("Winter's Tale," iii. 2)—

> "Casting forth to crows thy baby."

Or again of the probable fate of Bardolph at the war—

> "He'll yield the crows a pudding,"

in which I see a repetition of the classic "*βάλλ' ἐς κόρυκας* pascere corvos," to them a dire fate that their bodies should be a prey to carrion fowls, and not decently burnt.

As yet I have been speaking of the Carrion Crow, that generally selects a solitary tree in which to make its nest; but the Hooded Crow (*Corvus cornix*), or Hoodie, is not an uncommon bird with us, especially in the south-east coast, where it makes its nest in holes of the rocks. Those who know Dover must have seen great quantities of them sitting on the ledges of the chalk cliffs under the castle, or popping into holes. It is to these that Shakspear alludes in "King Lear" (iv. 6) when looking over Shakspear's Cliff—

> "The crows and choughs that wing the midway air
> Show scarce as gross as beetles."

This quotation brings one to the Cornish Chough (*Pyrrhocorax graculus?*), which at one time was common among us, but now chiefly confined to the far west. It is a bird that strikes one, with its black body and intensely red beak and legs, which look almost as though they had been brushed over with Aspinall's enamel. Shakespeare speaks of them in "Midsummer Night's Dream" (iii. 2) as "russet-pated choughs," though there is something to be said for the other reading—"russet-painted." Apart from its colour, it was its language that made most impression on the poet. When the empty-headed Osric comes to summon Hamlet to the fencing bout ("Hamlet," v. 2) he says, "'Tis a chough, I say"; and again ("Tempest," ii. 1)—

> "As this Gonzalo, I myself could make
> A chough, of as deep chat."

Or again ("All's Well that Ends Well," v. 1)—

> "Chough's language, gabble enough."

I have never met the bird in England, but I know it in the north of Spain and on the Alps, and fully indorse the above quotations. They are not shy. If one settles down to lunch, they will gather round and discourse largely—nay, some of the bolder ones will come up quite close, and pick up any fragment one may throw to them.

It was probably this oracular language of the Chough that made Shakspear put into Macbeth's mouth ("Macbeth," iv. 4)—

> "Augurs and understood relations are
> By maggot-pies, and choughs and rooks brought forth,
> The secret'st man of blood."

"Maggot-pies" has puzzled the ordinary reader, who has connected it with the putrescent corpse. But really the matter is quite simple. *Pica rustica*, the Magpie, was known in France as *la Pie*, and just as in English we have got into the habit of calling the Redbreast Robin, so in France they called *la Pie*, Margot, and our ordinary name is but the contraction of Margot-pie.

It seems odd that he should not have more fully appreciated the Daw (*Corvus monedula*), perhaps the most intelligent of this family. This he fails to recognise, for in "1 Henry VI." (ii. 4) he says—

> "But in these nice sharp quillets of the law,
> Good faith! I am no wiser than the daw."

Beyond that they merely strike him as a greedy pecking bird ("Othello," i. 1)—

> "Wear my heart upon my sleeve
> For daws to peck at."

Or again ("Much Ado about Nothing," v. 3)—

> "And choke a daw withal."

Entomology in Autumn.

By Claude Morley, F.E.S., &c.

The autumn calls up a curious mixture of feelings to the entomologist. If he be wise, he fondles that which most immediately affects him and ekes out the waning sunshine of midday to its full, with a persistent eye for his thermometer, upon which so much now depends. Let him catch a night of comparatively high temperature with a moonless sky, and none of the balmy twilights of midsummer, with all their gentle zephyrs and inducive dews, will produce such numbers of Noctuid moths upon his sugar. The reason is not far to seek; for, with the exception of ivy blossom, no counter-attraction lures his bag from the baits he so hopefully provides by daubing treacle, mixed with a little beer, coarse sugar, and some flavouring essences, upon the trunks of trees in woods, or strips of cloth laid on the gorse on heaths. "A most delightful pastime," you will grunt from the depths of an arm-chair before the fire; and truly it holds out quite infinite possibilities of stickiness and rheumatism. In fact, the average scientist, not overweighted with conventional niceties, will sometimes feel much like a fly on birdlime. But when you light the lamp and set forth an hour after sundown, through the silent lanes, to find what awaits you on the doctored trees, 'tis very lovely.

The darkness looses one's imagination till every bush a poacher, bludgeon-loaded, holds; the trees are unnaturally large, and every weasel in the grass becomes a thing to start at. Then, when you reach the woods, miles perhaps from houses, you find them very darksome, your lamp but deepening the gloom. Then presently the fun begins: the moths are feeding thickly on the trunks, their beady eyes gleaming unblinkingly in the noisome light, their wings serenely folded, probosces full outstretched, sucking up the nectar of their fate. You search the sugared patch from top to base, for the half-drugged insects will skip down and hide among the grass when frightened. For these you will have to search; while others, with premonitory quivering of the wings, dart off to the adjacent gloom. Sometimes the night-jars swoop along and snatch the moths from off the trunk beneath your very nose, which is unkind, especially when they choose a rare one; at others, toads squat beneath the sugared patch and glut themselves upon the drunken moths; while slugs and earwigs, centipedes and long-horned grasshoppers, also show a predilection for strong liquors.

The autumn, too, is the best time of year to dig with a trowel at the base of large trees for moths' chrysalids; and it will be found that the north-east face is the most prolific, because the caterpillar walks down the trunk to pupate during a warm day towards the end of summer, probably with a wind — which he, in common with all insects, seeks to avoid — from the south-west; and also because thence, too, come most of the drenching winter rains, which, permeating the soil, might cause his death by mould. All the large indigenous trees are productive; but great numbers of pupæ are usually overlooked unwittingly, through their exact resemblance to a lump of earth, and it has been asserted that the experienced digger effects more captures by his sense of touching the creatures with his fingers than actually seeing them with his eyes. It is well to begin pupa-digging early to anticipate that arch-entomologist, the mole, who devours our quarry with such avidity and circumspection that one of his runs at the base of a tree is good and sufficient reason for passing on at once to the next.

However good the collecting season has been, there is always a longing to see what is still on the move even up to the time that the Winter Moth and Winter Gnat alone people the bare and gaunt hedgerows. The last straggling heads of the Angelica will be inspected with more care in October than, in their abundance, they received in August; the late knapweed, ragwort, and yarrow, overlooked alike by the insects and ourselves in more fragrant days; the dank rushes in woody places; the thicker branches of the Coniferæ and the thickset heather on the uplands, all may still be searched with more or less hope of turning up rare and strange forms; for, though many have already gone into snug winter quarters, others, that will die off this year, yet cling to a dreary existence till their oviposition be safely accomplished.

But many autumn days will not admit of collecting, and plenty of time will now be found for turning to the classification and investigation of material amassed during the year. We will suppose you have a heterogeneous assembly of insects stowed away, anyhow, as they came to your net, in store-boxes and whatnot, and you now want to overhaul them, to divide them up into as natural a sequence of classes as possible. The first point to be examined is their wings. You will find the great majority is furnished with two pairs of these appendages, a good many have but one fully developed pair, and a very few have no wings at all. Those with one pair are easily separated, and you may be quite sure that they are all species belonging to the order called *Diptera* or true Flies, which is satisfactory. But those with two pairs are far more difficult. Among them are all sorts and conditions of insects, and you must next notice if the fore or upper pair of wings is of stouter texture than the hind or lower pair. All insects having thickened or hard fore-wings are referable to two orders; and, to find in which to place them, see if their mouth be constructed in the form of jaws for biting or of a proboscis for sucking. Those with jaws will have the whole of the fore-wings hard, and are *Coleoptera* or beetles; those with a proboscis are *Hemiptera*, and many of them (constituting the sub-order *Heteroptera* or bugs) will have half the fore-wings thickened and half membranous, transparent. The *Hemiptera* that have the fore-wings uniformly thickened are jumpers, with long hind-legs, and may be placed in the sub-order *Homoptera* (*cf.* F. N. Q. i. p. 41). The host of insects bearing four equally membranous wings are divisible into three sections, the first of which, *Lepidoptera*, embracing butterflies and moths, is known by the beautiful scales which nearly always entirely clothe the membrane both above and beneath; the second is distinguished by bearing no scales, though often (in its sub-order *Trichoptera*) the wings are hairy. This second section is called *Neuroptera;* it includes the Dragon-flies, with other familiar insects, and differs from the third order in the very numerous veins or nervures which criss-cross the wings in every direction. The *Hymenoptera* is the third order, and is made up of the ants, wasps, bees, ichneumons, sawflies, &c., in which the wings are always transparent, with comparatively few nervures. Lastly, we have to look at the insects in the collection which have no wings at all, and there will probably be very few of these, which is fortunate, since they are the most difficult to place systematically. Their mouth is of primary importance; if it is biting, the insect is probably one of the female *Hymenoptera*, whose male possesses well-developed wings; and if it is suctorial, the chances are in favour of its being a flea, which is generally placed in an aberrant family of *Diptera*, though by some is thought to constitute a separate order, which has been termed the *Siphoniptera*.

Thus most of the insects will fall under one or other of the groups named; the most prominent characteristics of each we may, for the convenience of the beginner, tabulate as follows:—

	Order.
A. Insects bearing four wings.	
a. Fore-wings thickened.	
α. Fore-wings horny; mouth mandibulate	Coleoptera.
β. Fore-wings leathery; mouth suctorial	Hemiptera.
b. Fore-wings membraneous.	
α. Wings clothed with scales	Lepidoptera.
β. Wings not clothed with scales.	
1. Nervures of wings very numerous	Neuroptera.
2. Nervures of wings comparatively few	Hymenoptera.
B. Insects bearing two wings; mouth suctorial	Diptera.

All these orders contain apterous species (wingless).

The above, though not intended to be an exhaustive conspectus, will enable the collector to arrange his insects in some order, and more minute details can be found in the works mentioned below.

Having thus roughly indicated the Great Orders of insects, I will leave you to run your collection down to definite species by the aid of Fowler's 'Coleoptera'; Saunders' 'Heteroptera' and 'Aculeata,' which latter are ants, wasps and bees; Edwards' 'Homoptera'; Buckton's 'Aphides,' the plant lice; and Newstead's 'Coccidæ,' which are parts of the

Homoptera not treated of by Edwards; Verrall's and Theobald's 'Diptera'; Cameron's 'Sawflies'; McLachlan's 'Neuroptera,' and Lucas's 'Odonata' or dragon-flies, which is a part of that order; Barrett's 'Lepidoptera,' and various other standard works, which do not occur to me at the moment, for their name is legion, and many of them deal with only one family or group. Several sections have been quite neglected in Britain, and we have nothing but scattered notes and monographs, in the various magazines, to help us in the determination of, for instance, parasitic flies of all kinds, which are extremely numerous, and cry aloud for students, who, we trust, will ere long arise to elucidate this tangled skein.

A Note on the Reproduction of the Slow-Worm.

By Rev. S. Cornish Watkins, B.A.

In view of the special attention which is given to observations on the life-history of our indigenous reptiles in the 'Field Naturalist's Quarterly,' it may be of interest to put on record the following facts which have come under my notice this autumn. In the last issue of this journal Dr Leighton dealt with the subject of Reproduction in his series of Reptile Studies, and the observations that I have made on the slow-worm (*Anguis fragilis*) since the summer number appeared seem to add somewhat to what was there stated.

On September 8, 1902, I captured two female slow-worms under a large stone in a disused quarry. They were evidently heavy with young. I placed them in a glass-covered box, with some damp moss, and kept them liberally supplied with slugs, their favourite diet. Each of them has since then brought forth a litter of young ones, the one on September 20th, the other on the 24th, and in each case the litter numbered twelve. This is the maximum number stated by Dr Leighton to occur. I measured the young ones on the day of their birth and found that they were 3½ inches in length, a size considerably larger than that given in the article referred to. From the time of birth they were extremely active, and commenced to feed upon good-sized slugs the day after they were born. One of the young, on being handled, disgorged a slug quite half-an-inch in length which it had swallowed.

I took several photographs of the mothers and the young together soon after birth, but on account of the extreme activity of the young ones they did not turn out as successful as I hoped. The most satisfactory perhaps is the one reproduced in this issue, but the incessant wriggling was most trying to the patience of the photographer.

This record may be of value in the first place as showing the time of the year at which slow-worms are born ; and secondly, in establishing the fact that they live upon slugs in the very earliest stages of their independent existence.

In spite of careful observation I have been unable to detect any signs of parental relationship between the mother and the family, which corresponds with what has been stated by other observers.

[The above observations are most valuable, and Mr Watkins is to be congratulated on being so fortunate as to obtain the specimens described, and upon his excellent illustration of the family. We stated that the time of birth was August or September, and in a cold season like the present has been, the latter month would naturally be the one for the event to occur in. The size of the young in these two cases is most interesting, and greater than the measurements which had previously come under our own notice. Doubtless, as in adders and other reptiles which are ovo-viviparous, the size of the young at birth varies much,—probably both these parents were large ones. The food in captivity is of course what the owner chooses to give them, but it is interesting to note that the young ones take to the food of their elders so soon.—Ed. *F. N. Q.*]

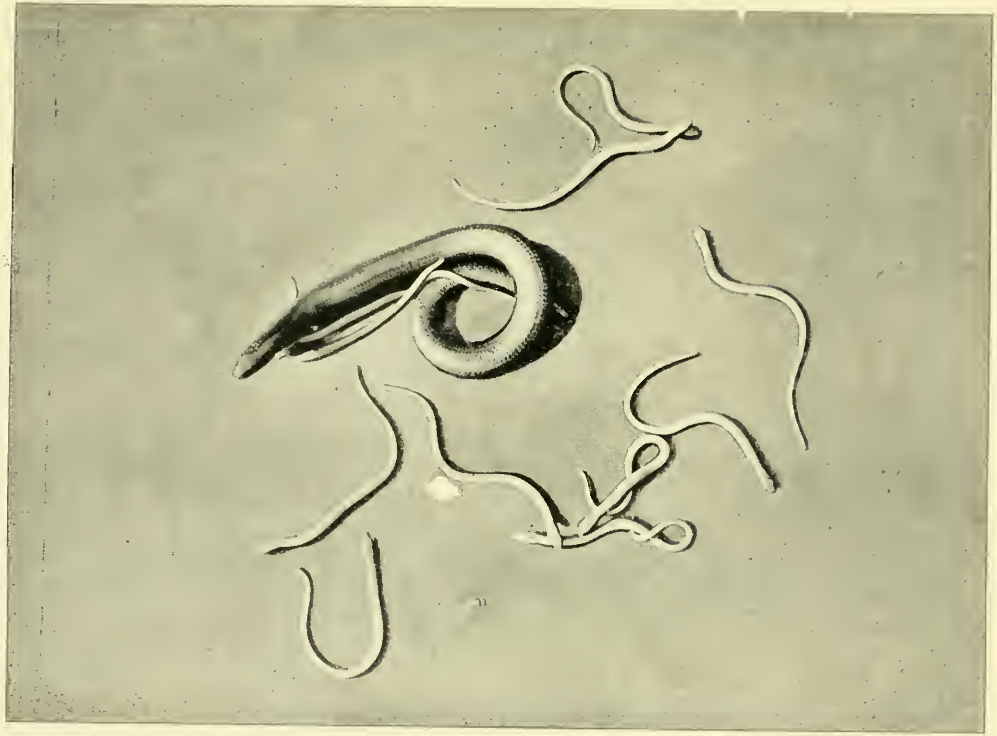


Photo by S. Cornish Watkins.

FEMALE SLOW-WORM WITH YOUNG ONES.

Fish Notes.

By F. G. Aflalo, F.Z.S., F.R.G.S.

I. *Some Monster Fishes.*—America is the land of big things, and its fishes are certainly not unworthy the national craze for records. This ambition to do the biggest thing is geographically bounded by the Panama Isthmus to the south; otherwise the Brazilian arapaima, which grows to a weight of 300 lb. or 400 lb., and to a length of 15 or 16 feet, and is in fact the largest of fresh-water fishes (save perhaps one or two of the cartilaginous sharks found in Eastern rivers), would also fill the national ideal. I have just opened my 'Forest and Stream' for September 20, and in it the portrait of a sea-bass weighing 419 lb. and details of a halibut of 325 lb., both taken in American seas, stare *vis-à-vis* from the pages, and suggest the text of this note.

With the feverish possibilities suggested by this giant bass from the angler's standpoint—it was caught on rod and line —it would be indiscreet to occupy myself in this place. This is, it may however be mentioned in passing, the record sea-bass, being 35 lb. heavier than the previous biggest fish. The halibut was taken on a hand-line, and it took the combined strength of four men, holding on to a gaff and spear buried in its huge body, to lift it into the boat. The reason of this added difficulty in the case of the flatfish may be sought in the greater resistance offered by its body to the water, through which a round fish, pulled head first, would naturally move with less friction. It is within the experience of every amateur sea-fisher that even small flatfish are most deceptive in the matter of real and apparent weight, for they have a trick of curling up in the water, which throws a far greater strain on the tackle and on the fisherman's hand than would be exerted by a round fish, such as a cod, of twice their weight.

Not even this great sea-bass is the largest fish taken on rod and line in the littoral waters of the western continent. Mr Von Hofe, the well-known maker of tarpon-tackle in

New York city, has caught sawfish, if I remember right, up to 500 lb. and 600 lb., while the heaviest tarpon would probably fall short of 200 lb. There is also another great angler's fish in those seas, the tuna, which is, I believe, identical with the tunny of the Mediterranean and other waters in Southern Europe. It will be noticed that many fish families are represented by these giants. The tuna is a distant relation of the mackerel; the tarpon of the herring, though anything like relationship between the tiny whitebait and the massive tarpon may smack of paradox. The great sea-bass is a kinsman, though a remote one, of our little river perch, and, more nearly, of our own sea-bass at home. The sawfish, of course, is one of the shark family, in which there are some far greater monsters, not, however, associated, even indirectly, with fishing for sport. The halibut is one of the flatfish, and it even grows to a moderately large size in our own seas, and more particularly in those colder waters in the neighbourhood of Iceland, increasingly exploited by our fishing-boats. When we compare these gigantic fishes with the smallest living fish known, a tiny creature found, I believe, in the inland waters of the Philippines, and measuring in its adult form only about a quarter of an inch, we find indeed a marvellous range of size. Yet the lilliputian in question is as perfect as the brobdingnagians aforementioned, and doubtless it lives its life and reproduces its species as completely and as usefully as they do. The battle may be to brawn and muscle in some classes of animals, but, in the absence of greater enemies, a small fish is as good, from its own standpoint, as a large one any day!

II. *Winter Fish Movements at Sea.*—Those who know how to read the signs and portents find the phenomenon of migration as interesting every whit among our fishes as it is among the more conspicuous birds. Most of us are familiar with the yearly departure of the swallows and martins, the twittering little travellers massing on our south coast headlands and of a sudden leaving our shores in their thousands, old and young, for the milder winter of northern Africa. The winter arrivals of ducks and geese and the other feathered folk frozen out of arctic ice-fields are less observed, chiefly because at the inclement season of their approach, which is often timed at night, the east coast is not the resort of any who can contrive to live away from it. They come from the north-east for the most part, these winter wildfowl, and only the watchful gunner and the enterprising poulterer can, as a rule, tell you of their coming. With the fish it is all so different. Here are tens of thousands of silent, secretive visitors, coming and going, unseen, unheard. The only outward sign of their movements vouchsafed to the general unscientific public is the fishmonger's slab. Here the experienced housewife knows that she will find salmon at one season and at another cod and whiting. Dory and garfish will not, as a rule, lie alongside shad and bass. At one time there is a plethora of herrings; at another mackerel or gurnards will predominate.

The amateur fisherman, who is generally something of a naturalist in his own unfettered way, takes more intimate account of these travels among familiar fishes. He knows well that the shoaling bass that came with the swallow depart with it. The brief visits of the shad to our rivers he heeds but little, for the shad is, though not unknown in that aspect, a most uncommon capture on the hook. It is in autumn and winter, however, that he has most occasion to note the movements among the shoals. The cod and whiting come along the shore in this season with the sprats and herrings, and the sportsman may repair to his favourite resort, be it Deal or Aldeburgh, as confident of finding the fishes of the season as the wildfowler of bagging his mallard or widgeon. As a personal observation of this general westward flight of wildfowl this season, I may mention that before the end of September I had, on the Devon coast, seen six or eight small flights of duck, both mallard and scoter, going in every instance to the westward. With the migrating fish of the Channel it seems to be otherwise. They move in from the open Atlantic, and we get the first evidences of their arrival from the south Irish fishing fleets—or rather from fleets working the bays in the south of Ireland—their progress up-Channel being then noted at consecutive ports from west to east.

III. *Lake Fish.*—The gigantic trout lately reported from such New Zealand lakes as those of Hayes and Wakatipu can compare in stature only with the trout of Lucerne and the salmon of Wener. The world's lakes produce indeed salmonidæ that seem to excel those of the greatest rivers. In the case of New Zealand we must probably look to superabundance of natural food for a not indigenous fish as the chief, if not the only, cause of such phenomenal increase as a recorded growth of 15 lb. in five years. Some of the American and Canadian lakes have a characteristic fish in the pickerel, a kind of pike, and the pike of one or two Irish lakes, or loughs, have at all times taxed the credulity of every class but anglers. Our own Loch Leven is famous for its trout, over 20,000 lb. weight of which have been taken on the hook in a single year. Touching these trout, Sir John Murray has brought a curious fact into more general notice —viz., that they took to the artificial fly only since the year 1856. To what influence, physical or psychological, we are to attribute this comparatively recent change of habit, it would be interesting to learn. Our East Anglian Broads are hardly perhaps lakes in the school-geography definition of the term, but for zoological purposes they may be so regarded, and this warrants me in including among the notable lake fish of the world the pike of Barton and Oulton and the bream of Wroxham and Fritton. They are unrivalled.

An Extinct Butterfly (*Chrysophanus dispar,* HAW).

THE LARGE COPPER.

By J. R. CHARNLEY, F.E.S.

"THE animals," writes Mr W. B. Tegetmeier in the 'Field' (1893), "that have been exterminated by the agency of man are not confined to any one group. We know that he has destroyed many of the larger and more interesting vertebrates, and this destruction is going on at a rapidly increasing ratio. The most gigantic of all modern birds, the moas of New Zealand, were killed and eaten by the Maories. The dodo and the solitaire were exterminated by the Dutch navigators. Within the present century the great auk has become extinct, and as large and as beautiful an animal as the quagga appears to have become a thing of the past. All these larger animals have been destroyed by the direct agency of man, others have been indirectly affected. Of the latter, one of the most remarkable is what was formerly a common species of butterfly, known to lepidopterists as the large copper (*Chrysophanus dispar*), which formerly occurred in abundance in Whittlesea Mere and in the Huntingdonshire fens, but which is now believed to be quite extinct, no specimen having been captured for nearly fifty years."

The four wings have the costal margin nearly straight and rather pointed at the apex; the hind margin is a little rounded and in the hind-wing slightly waved. In the male the ground colour of the upper surface is bright fiery copper. The fore-wings have a rather narrow black hind margin, which is broadest at the apex, a fine linear traverse black spot at the extremity of the discoidal cell, and a smaller and less distinct one between this and the base. The hind-wings have a black indented hind margin with a short dark fuscous median streak.

The sexual difference of the upper surface of this species is very remarkable.

The female, which is of the same coppery hue as the male, has the hind margin of the fore-wings broader than in the latter, and in addition has a row of seven oblong black spots parallel with the hind margin and three more distinct ones in the discoidal cell, decreasing in size from the extremity. The hind-wings are brownish-black, with a coppery orange band inside the black hind margin. Beneath, both sexes are alike. The ground colour of the under surface of the fore-wings is light orange red with a hind margin of ashy-grey; there are three black spots placed longitudinally on the disc and a traverse row near the hind margin, forming an undulating line across the wing, all of which are encircled with pearly-grey; bordering the hind margin is an ill-defined row of unequal-sized dark fuscous spots. The hind-wings are ashy-grey, inclining to pale silvery blue towards the base, with a short slender oblique streak at the extremity of the discoidal cell; parallel with the bluish hind margin is a band of bright orange, on each side of which is a rather indistinct row of dark fuscous spots; on the disc are numerous other dark spots of various sizes, all possessing a pale circumference.

As examples of the prices which have been obtained for the large copper, an auctioneer in 1893 disposed of (as recorded in the 'Field') some 31 specimens of this butterfly (part of the collection formed by the late Rev. Henry Burney), when the 31 produced in the aggregate no less than £138, 15s., or on the average a little over £4, 10s. each, and two wings attached to a pin were sold for 30s. at a previous sale. Again, at the commencement of the present year, nine other specimens were disposed of, when the average worked out at a little over £4, 18s. for each of the nine specimens, £7 being obtained for a fine female example.

That the large copper is now absolutely extinct there can be no doubt, for, needless to say, collectors have ardently searched the fen districts for many years since its disappearance about 1848, but no specimen has been taken since that date.

In consequence of its not being absolutely identical with any Continental species (the nearest ally being *Rutilus*), there is much interest attached to it. Fortunately its life-history is comparatively well known, though the very earliest stages of its existence are only partially known: the late Mr Edward Newman, who was well acquainted with the insect, states that the young larvæ were never, to the best of his belief, observed.

The egg was laid towards the latter end of summer, on the leaves of the water-dock (*Rumex hydrolapathum*), and the young larvæ probably hatched about a month later and hybernated at the bases of the leaves.

According to Newman the larva "is full-fed in June, and then lies flat on the dock leaf, rarely moving from place to place, and, when it does so, gliding with a slug-like motion, the legs and claspers being entirely concealed. The head is extremely small, and can be completely withdrawn into the second segment; the body has the dorsal surface convex, the ventral surface flat; the divisions of the segments are distinctly marked, the posterior margin of each slightly overlapping the anterior margin of the next, and the entire caterpillar having very much the appearance of a *Chiton;* the sides are slightly dilated, the legs and claspers are seated in closely approximate pairs, nearly on a medio-ventral line. The colour is green, scarcely distinguishable from that of the dock leaf; there is an obscure medio-dorsal stripe, slightly darker than the disc, and in all probability due to the presence of food in the alimentary canal." The same authority describes the pupa as "obese, blunt at both extremities, attached by minute hooks at the caudal extremities, and also by a belt round the waist," while the colour is said to have been first green, then pale ash, with a dark dorsal line and two abbreviated white ones on each side.

The perfect insect emerged towards the end of June or the beginning of July, and was seen on the wing from that time until the latter end of August. Mr Bond, who had "personal acquaintance with living *Dispar*," states that "they are very active and shy, and would only fly when the sun shone; they would always settle on a thistle when they could find one in bloom, flying off to attack any insect, no matter what, that might come anywhere near them—not always returning, but generally passing on to another place. It was very little use following them if you missed your first stroke with the net, as they went away like the wind and seldom let you get a second chance; indeed it is difficult to follow them, as keeping your eyes on them and the boggy places was rather a difficult job." Mr E. C. F. Jenkins, of Sleaford, informs us in 'The Entomologist's Weekly Intelligencer' (1859) that on one occasion he took 16 specimens in half an hour on one particular spot. Mr J. W. Douglas, writing to the same periodical in 1859, says: "I made a pilgrimage to Whittlesea Mere in 1841, on purpose to see the beauties alive; but it rained every day during the week I was there, and I only saw a solitary specimen, which ventured to open its wings during a transient gleam of sunshine. Now, whenever I look at that butterfly in my cabinet, the recollection of the moment when it flashed its glory before me always comes like a new pleasure."

The large copper was never observed in Scotland or Ireland, and seems only to have been met with abundantly in England in the two counties, Cambridgeshire and Huntingdonshire. Its favourite haunt in the former county was at Whittlesea Mere; in the latter Yaxley and Holm fens. It appears to have become extinct in Cambridgeshire in 1845, while Mr Bond informs us that the last "take" in Huntingdonshire was made at Yaxley in either 1847 or 1848, and consisted of five specimens. This is the last "take" on record.

The causes which led to the extermination of the insect have never been completely explained. Mr Newman attributes its disappearance to the floods to which the young hibernating larvæ must have been subject during the winter. It is, however, difficult to see how this could have been the sole or even the main cause, seeing that floods could hardly have been peculiar to the period at which the butterfly became extinct. It would seem that most probably the chief cause of its extirpation was the drainage of the fenny districts which had hitherto formed its exclusive haunt, aided by the burning of the surface-growth, done during dry weather when the land was to be reclaimed; and to this must be added the unceasing attacks of collectors.

The changes during the past century which have been brought about by the industry and progress of man have indeed been great; steam draining mills and the general improvement in agriculture have changed the marshes into pastures and corn-fields, and there were few districts in the fen country at the latter end of the century in which the whistle of the locomotive was not heard.

As an instance of the changes that were taking place in the fens, Mr E. C. F. Jenkins, in a note made in 1859, says: "Thirty years ago the fens about Whittlesea Mere were most interesting localities for the entomologist, the botanist, and the ornithologist. I lived then in that neighbourhood, and those pursuits were my delight. *Papilio machaon* might then be had to any amount; the flight of *Chrysophanus dispar* was abundant in July; the moth *L. dispar* was very plentiful;

besides many other rare and beautiful insects. Now, however, everything is totally changed. The Great Northern Railroad runs through a part of the fen where, when I was a boy, one could scarcely walk; at the spot where I used to land from my boat, on the edge of the mere, stands a farmhouse; my favourite locality for *C. dispar*—where the bog myrtle used to grow in profusion and scent the air with its delicious perfume—was (as I myself saw last season) converted into a field of stinking cole-seed, with a flock of sheep eating it off. All the better, no doubt, for the landowners, but ruinous work for the naturalist, and as such you will sympathise with me in the destruction of what was one of the most interesting localities in the whole country for persons inclined to such pursuits."

About this time, too, collecting became more general, and the discovery of the larva, which until some years prior to the extermination of the species was unknown, led to the indiscriminate attacks of collectors. Whatever else may have contributed, in a lesser degree, it is clear that these two influences must have played the most important part (if, indeed, they were not actually the sole agents) in the complete destruction of the species, as it is certain that from the time of the extensive drainage of the districts, already referred to, and the persistent attacks of collectors, the species rapidly decreased in numbers—a decrease followed speedily by their total extermination.

Unfortunately, it is to be feared that our other fen species of butterfly (*Papilio machaon*) will share the same fate (that is, of course, as regards our islands, for it is a common insect on the Continent), though happily at no early date, for in the Norfolk Broads there are prospects of its remaining on our list for many years to come.

On the Occurrence of *Cotula coronopifolia* in Cheshire.

By E. M. Wood, Liverpool Naturalists' Field Club.

About the year 1886 the discovery of *Cotula coronopifolia* at Leasowe, Cheshire, created no small curiosity amongst local botanists, and it was not until a specimen of the plant had been referred to Kew that its identity was fully established. The locality of the new home of the Cotula—a native of Northern Europe—is the wind-swept and not altogether picturesque portion of land on the sea-coast of Wirral, lying about midway between New Brighton and Hoylake, where the castle and lighthouse, and, up to recent years, only a few scattered cottages, were the only buildings in existence. Situated among the line of sandhills extending along the coast, the flat marshy and sandy ground comes as a break and divides the sandhills into two distinct portions. The low-lying land is protected here from the sea by a massive embankment, which is rapidly growing in favour as a promenade for those who wish to enjoy the invigorating breezes blowing over the waters of Liverpool Bay. A little to the south of this embankment are the remains of a submerged forest, which serve as an unending source of controversy and exploration to our local geologists!

The history of this alien plant—which, by the way, is one of the Compositæ—so far as can be ascertained, is, that a specimen was brought from Norway by the late Lady Cust of Leasowe Castle and planted in the grounds. There it grew and flourished exceedingly, and some roots became conveyed to a fairly shallow ditch running at right angles to the shore and divided by a field or two from the garden of the castle. Since 1886 it has spread far and wide, and most of the ditches which drain the surrounding fields are thickly populated with the pretty little plant. The plant, which even now often puzzles new-comers, accommodates itself to circumstances, growing in damp spots among turf;

on the muddy edges, or actually in the water of the ditches, and here, of course, it is at its best. It is a much-branched perennial, growing to a height of from 8 to 12 inches; the stems are ascending, and rooting at the nodes; succulent, but not hollow, and bearing green leaves, which are fleshy, glabrous, and amplexicaul—the upper ones lanceolate, strap-shaped, the lower usually divided into narrow lobes, not unlike the antlers of a stag, hence its name of "coronopifolia."

The compact capitula are terminal, and have much the appearance of daisies deprived of their ray florets. This characteristic singles out the plant at once as peculiar. The disk florets are bright yellow, very small, the narrow corolla having four blunt lobes; the ray florets are reduced to minute greenish scales closely hidden by the bracts of the involucre.

Such is the appearance of the Cotula, which has become naturalised on our bleak Wirral shores. Its flowering time is from May to November, and it is an exceedingly pretty sight to see its hundreds of yellow buttons ornamenting the ditches, here and there associating with the water crowfoot, but, like the daisy of the land, it has a tendency to drive out other water plants once it establishes itself in a congenial spot.

Norman Architecture.—III.

By Rev. P. J. Oliver Minos, Ph.D., M.R.A.S. (Lond.)

I have in a former article pointed out that in the early Norman period there was a singular lack of ornament, and much even of the middle Norman period was very plain. To determine whether plain Norman work is of early date, there is an almost universally acknowledged rule—viz., the early Norman work is wide-jointed, *i.e.*, there is considerable thickness of mortar (often found to be half an inch or more thick) between the joints of the masonry; whereas the later Norman work is fine-jointed, *i.e.*, there is very little mortar between the joints. An effective contrast between wide-jointed and fine-jointed work may be studied in the walls of

Winchester Cathedral, where the former adjoins the latter in the rebuilding of the central tower, done in the beginning of Henry I.'s reign.[1]

Further, the Norman mason in his early work used stones of various sizes, and caused thereby the joints to be irregular. Such irregular, rough-jointed works are commonly called "snail-creep." In the twelfth century the said mason used stones well squared and of more uniform size between thin joints, and these were finely put together. These indications of date once noticed will always be remembered and looked for in distinguishing early Norman work from later Norman work.

Next, how is one to distinguish Norman work from any other work? Norman work (whether early or later) has one definite peculiarity—viz., the diagonal tool-marks,[2] which are found in no other style. They are seen in parallel lines, always diagonally across the surface of the stone if plain; but following the lines of arches, mouldings, &c., if not plain. These tool-marks appear in the early buildings almost like saw-marks, doubtless due to the adze. Professor T. Hayter Lewis, on diagonal tooling, says, "Personally, I know of no instance of such markings being used in any other style, nor anywhere after the twelfth century, and when we find it, no matter how far eastward, we can trace it distinctly to Norman influence."[3] To show the value of these tool-marks as a mode of identification, I will quote that accurate observer, Major Conder, R.E., who, in the 'Palestine Exploration Fund, Quarterly Statement, 1874,' pp. 92, 93, writes, "The masonry is sufficient to class buildings—viz., diagonal dressing, which was not in earlier work than the Crusaders." Professor T. Hayter Lewis also says, "I have not the slightest doubt that this Norman work was distinctly the product of western art, and that it was imported into Palestine, Sicily, and wherever else found at the time of the Crusaders. There was nothing like it in Palestine, so far as I am aware, before this time." All the Palestine works referred to in the above were built between A.D. 1140 and 1180.[1] They were designed in the Norman style, and were of similar kind of buildings as those erected at the same time in Europe. Here, I think, I ought to point out that the Norman architecture was developed at the end of the eleventh century, became more refined and intricate at the middle of the twelfth century, and then was superseded by the Early English. The first of these dates coincides with the capture of Jerusalem by the Crusaders in A.D. 1099, and the last with the recapture of Jerusalem by Saladin in A.D. 1187.[2]

---

[1] The change from wide-jointed to fine-jointed took place about A.D. 1120. William of Malmesbury, in his description of the buildings erected by Roger of Salisbury, noticed this change; fragments of his fine-jointed work remain at Sherbourne Castle.

[2] Sometimes called "cross-tooling"; but this term is apt to be confounded with the Saxon tool-marks, which may for distinction's sake be called "cross and recross tooling."

[3] Compare Professor Lewis's paper read at Glasgow in 1888, and printed in the 'Transactions of the British Archæological Association.'

Having briefly pointed out the external indications of Norman work, I will now draw attention to some of the internal indications. The word "capital" is so well known as to require no definition. Its form is often a guide as to fixing the date of the building. The upper part of the capital out of which the arch mouldings rise is called "abacus," and its square form in all Norman work is particularly noticeable. In the Transition period both square and circular forms of the abacus are met with side by side, just as semicircular and pointed arches occur together. This mingling of these forms is only to be met with in the Transition period. The choir of Canterbury Cathedral, rebuilt in A.D. 1174—*i.e.*, four years after the murder of Thomas à Becket, Archbishop of Canterbury—is the finest example, I think, of this mingling of the two said forms. The "round" of the Temple Church, London, is another good example.

The most common shape of the body of the capital is what is commonly known as the "cushion shape." It is simply a square block of wrought stone with the lower ends rounded off. It occurs so frequently that almost any Norman work will be sure to supply examples. Bear in mind that the early form of the cushion capital is generally convex—*i.e.*, bulging outwards; whereas the cushion capital in later work, even though it be richly ornamented with mouldings, is usually concave or bell-shaped. The concave form was produced in Transitional work by four leaves springing from the annulet—*i.e.*, the moulding surrounding the neck of the shaft—with their points at the corners of the square abacus. Sometimes the capital is carved with "volutes," and in the later Norman period the capitals are scolloped; occasionally the head is very elaborately carved.

---

[1] Dr Cunningham Geikie in his 'Holy Land and the Bible' says, "Every part of the country bears witness to the gigantic energy of the western nations, great forts, churches, hostelries, being built as if to last for ever."

[2] Towards the end of the twelfth century the Crusaders' hold on Palestine became very insecure. In 1185 Heraclios, the Patriarch of Jerusalem, together with the Grand Masters of the Templars and Hospitallers, gave to Henry II. the keys of the Holy Sepulchre as an appeal for help. The Patriarch then dedicated the Temple Church, London.

Moreover, besides the external and internal indications of Norman works, the plan and internal arrangement of churches of this period are to be noticed. First, as to the plan. The large Norman churches, such as cathedrals, abbeys, &c., were as nearly as possible cruciform, but the small parish churches were mostly oblong in shape, east to west. During the early period of the style the eastern limb of the cruciform church—the chancel, or rather the sanctuary—was built quite short in length, with or without a semicircular end.[1] In the majority of cases the sanctuary was lengthened, and wherever the semicircular end existed it was either finished off into a rectangular apse or, as in most cases, squared. Next, as to internal arrangement or fittings of a church. The altar was always at the east end, the font at the west end. Hence the necessity of some kind of division. The Norman church-builder understood this reason why, and strove to present the chancel arch in its fulness of light and shade.

One of the most striking objects of internal furniture[2] of a church that has come down to us from Saxon and Norman times is the font. In ancient times natural springs or fountains were venerated; the early Christians utilised such springs (only in the absence of rivers) for baptism. Later on in the history of the Christian Church, when a special vessel was placed in the church for the rite of baptism it was called a font. The early Norman fonts were circular; the later Norman fonts were square or octagonal, with a deep circular bowl for immersion. Let me here emphasise that in identifying Norman fonts no one ought to omit looking for the diagonal tool-marks. The existence or non-existence of these tool-marks tell us in unmistakable language whether the specimen is Norman or not; whereas ornaments sometimes mislead us by being added later on. The early Norman font was very plain; the middle and later Norman font was often enriched with carvings of grotesque character, as in the case of Winchester Cathedral font. When religious symbols came to be used, fonts received their due share. The symbols for the Holy Trinity, the Holy Ghost, &c., are often met with on fonts; in fact, the circular fonts represent the world, the square fonts the cardinal points of the globe, and the octagonal fonts the Holy Spirit and His sevenfold gifts. The Norman font was made of stone, wood, and even lead. There is a very good example of leaden font at Walton-on-the-Hill, Surrey; another leaden font[1] of late Norman date is at Brookland, Kent. The Norman circular font rests on one thick stunted column; but when fonts began to be angular, smaller columns were added under the angular corners round the central column. I have seen four small columns and one central column, but not eight small columns and one central column.

---

[1] The absis or apse came down from the Romans, whose courts of justice and temples were so terminated. Of the latter, Hadrian's temple of Venus at Rome is well known to archæologists.

[2] Among the church furniture of Norman days we do not generally come across pulpits, because preaching was done from the altar-steps, or sometimes from the rood gallery.

In conclusion, I will add a few words as to the church towers. The Norman church towers were not always central—*e.g.*, in case of a cruciform church, the tower was at the crossing of the arms; but in oblong churches the tower was somewhere at the west end.[2] The towers of most Norman churches seem to have caught the characteristic expression of the Norman castle keeps; in fact, some were actually defensive towers. The Norman church towers are always massive,—very thick walls surmounted by low square roof. Castor Church, Northamptonshire, is remarkable for her exceedingly fine Norman central tower.

---

[1] There are altogether about twenty-five leaden fonts in England, and these are supposed to be of late Norman period.

[2] I know of only one instance where the church tower (originally detached) is placed on the west *diagonally* to the nave—viz., Garway (Herefordshire) Church tower. This tower was used as a prison to the border castles of Grosmont, Skenfrith, and Pembridge (Welsh Newton).

ADDENDUM.

In my second article, under the head of Norman Architecture, I briefly referred to the origin of the most common ornament of the Normans — viz., the chevron or zigzag. This pattern is not to be found in classic architecture: it is a barbaric pattern. In Ray S. Lineham's 'The Street of Human Habitations,' on p. 34, we find, "Here is one of the most beautiful objects used by the Bronze Chief in his temple. It is the horn or trumpet with which he is accustomed to call his tribe to worship, and perhaps also he adores his god with a blast imitative of the awful thunder peal, and peculiarly acceptable on that account. Upon it you can discern quite a number of Bronze Age symbols." Among these symbols we see distinctly the sun-snake or svastika, the zigzag, &c. The sun-snake is a special emblem of fertility; the zigzag is the representation of the zigzag flashes of lightning.[1] Thus the bronze horn found in the bog of Wismar throws ancient light on the zigzag. This bronze horn is not a solitary instance; in fact, the Bronze Age[2] will give a number of instances in which the zigzag was used (see pottery of the Bronze Age in the British Museum). Also, in the Iron Age we find the zigzag on coats of mail, amulets, &c. These zigzags are seldom seen without the sun-snake or svastika or triskele—sacred symbols of the sun-god. The svastika has been very generally allowed to be a symbol of the god Thor, who, to the Scandinavians, was the god of thunder and lightning, and of the domestic hearth, and therefore of fire also. On comparing the results of the bog-finds of Sweden, Norway, and Denmark, it would seem that the svastika is the most rare in Sweden, most common in Norway, and that the sun and fire symbols became disused in Sweden and Denmark about the twelfth century —*i.e.*, about the time that Christianity was introduced there.

---

[1] Instantaneous photography has revealed the fact that the former method of representing lightning as a fiery zigzag was entirely incorrect.

[2] The Bronze Age, as regards Scandinavia, the late Dr Worsaee fixed at from B.C. 500 to A.D. 100.

Therefore I conclude that the Norman (North-man) zigzag is the same as the Scandinavian and the Danish zigzags. These zigzags were accompaniments of the svastika or sun-snakes—*i.e.*, the symbols of the flashes of lightning accompanied the symbols of the thunder. Moreover, I think that the sun-snakes and the zigzags were originally suggested by the motion of the snake and by the yellow-brown zigzag marks on the adder. In reference to this, I will point out that a Norman arch with a snake carved actually exists in the tower of Leominster Priory Church.

Toothwort (*Lathræa squamaria*).

By James Greig.

Toothwort is a plant destitute of chlorophyll, and so must acquire its hydrocarbons through other agencies than sunlight. The seeds, which are minute, and are unlike those of other members of the family of Orobancheæ in having the radicle, stem, and cotyledons fully differentiated in the embryo, germinate in the damp leaf-mould under or near trees, such as the hazel and sycamore, in early spring. They throw out rootlets, and if these rootlets come near or touch the roots of any tree after the sap has begun to ascend, they throw out fibrous processes with suckers at the end which fasten upon the tree-roots. In the centre of the sucker a process is developed which pierces the tree-root through the vessels down to the wood, and extracts the sap for its own purposes. Thus the plant grows for a while underground, projecting above ground an inflorescence, the part which is usually taken as a specimen of the plant. But underground the plant continues to grow in the spaces between the roots of its hosts until it may attain the weight of many pounds. The underground stem is formed like the stem which bears the inflorescence, and has thick fleshy leaves. At the lower end of the leaves, just where they are attached to the stem, there is a semicircular canal formed by the involution of the dorsal end of the leaf. About ten chambers, being excavations in the dorsal substance of the leaf, are entered by minute passages from this canal. These chambers are lined with cells of two kinds—one set being capitate, the other dome-shaped. When the cells are stimulated they send out protoplasmic filaments similar to those which we see under the microscope in rhizopods and other protozoa, such as the Wheel and Sun animalcules. Now, small animals in search of food or shelter enter these chambers by the passages. They enter, but do not return, for the stimulus of their presence causes the cells to extrude the filaments which bar their exit. The filaments envelop the animals just as the amœba seizes its prey, and soon there is nothing left but chitine and other indigestible matter; every particle of nourishment which their bodies contained has been absorbed by the protoplasm of the filaments.

Now, here there is no secretion, no provision of a peptic ferment, such as we find in other insectivorous plants, no interference from the outside as by the bacteria of putrefaction, but the protoplasm of the cell in its individual life acts itself as a ferment for the preparation of the food and fits it for transmission from cell to cell for the nourishment of the plant.

We have seen that toothwort is a parasite, and derives a large portion of its nourishment by abstracting the elaborated sap from the roots of trees growing near it; indeed sometimes these tree-roots may be seen covered as if by lacework with the adherent fibrous rootlets of the toothwort. The process which issues from the disk by which the rootlets adhere, and which is named the sucker or haustorium, penetrates the roots as far as those vessels between the cambium and the bast, which are known as sieve tubes. These tubes are filled with an "amorphous proteinaceous slime," as Sachs says, which is not protoplasm, but circulating proteids in a state of solution, such as transitory starch and sugar, and the various substances derived from carbon assimilation which are being conveyed to the different points of growth. Into this fluid the haustorium plunges, and from it the protoplasm of the cells composing it derives materials for growth. Now it is evident that the fluid, elaborated though it be and fitted for the nourishment of the tree in which it circulates, cannot without some preparation be suited for the nourishment of the toothwort. This, in great measure at least, is effected by the cells composing the haustorium in their individual act of living. We have a closely analogous case in the growth of the embryo. The cotyledons grow at the expense of the endosperm provided for the nourishment of the embryo, and after elaboration convey it back to the point of growth.

Lastly, we have growth by absorption of nutriment by the roots.

Toothwort, not having the means of manufacturing organic matter out of inorganic, must, like animals, make use of those organisms which have the power. Here, in the place where it commonly grows, there is an abundant supply of matter that originally was woven together by the energy of the sun, for the soil is almost entirely composed of the decaying remains of green-leaved plants that have lived and died. It is this matter that it is the function of the roots to absorb, and to fit it for assimilation to build up the tissues of the plant. The active agents in this function are the root-hairs. These are tubular prolongations of single cells of the epidermis, open at the end next the root, closed at the end nearest the substance to be absorbed. The whole structure is surrounded by a very delicate and elastic wall of cellulose extremely permeable by water. This is lined by a very thin layer of nucleated protoplasm. The interior being filled with cell sap, osmotic pressure keeps the structure tense. For osmosis is the means of transmission employed; but this osmosis is very different from osmosis in a laboratory, where a dead membrane or other lifeless substance is employed. Here the filtration is through a living membrane, the cells composing which are in full active life and have control of the osmotic process, for nothing can enter the cell sap without traversing the living protoplasm. We know that the protoplasm has power to bar the entrance of some substances and to encourage that of others, and it is probably to this that plants owe the power of selecting food, and that to all intents the ash of plants is of a constant composition. It seems certain, also, that after entrance has been obtained the protoplasm has, and exercises, powers of analysis, synthesis, and reconstruction.

Thus in toothwort we can study the action of the protoplasm in cells acting as organs of nutrition—firstly, in the presence of highly organised matter; secondly, of matter in the process of organisation; and thirdly, in the presence of unorganised matter. The study is most interesting, and affords an ample field for the investigations of the physiologist.

Some Deep-Sea Plunder.

By A. E. Johnson.

The piscatorially-minded naturalist suffers always from this disadvantage as compared with his fellows of the field, that his observation of species under natural, or semi-natural, conditions must be constantly attended by great, if not insuperable, difficulties. But awkward as are the obstacles which beset the fresh-water naturalist, his plight is as nothing to that of the would-be student of marine life. It is true that certain species—the 'longshoremen, as one might say, of the fishy world—can be observed with advantage in the rock-pools left upon the shore by the retreating tide; but with the finny denizens of the deep seas, observation must perforce be confined to such as is rendered possible by the net, the dissecting-room, or even the fishmonger's slab. Consequently, it is hoped that these jottings from the note-book of a lay brother, made in the course of a voyage aboard a Grimsby steam-trawler to the fishing grounds of Iceland, may be of some slight interest to those unacquainted with the humble haddock or the plebeian plaice as they appear when first dragged ruthlessly from their native element.

For the benefit of those not learned in the lore of fisheries, it may be well to insert here a prefatory note as to why it should be necessary to go so far a-field—or rather, a-sea—in order to supply the suburban breakfast-table. Most people are accustomed to think of the more usual varieties of fish which they eat as having been taken from the North Sea. When they spend their holidays on the East Coast they observe with interest the various fishing fleets, and picking up a dangerously small modicum of knowledge, return to town to speak airily of smacks and trawlers, and refer vaguely but familiarly to the Dogger Bank, as if they had been in the habit of cashing cheques there for years. Time was when this common supposition was justified; but the old assertion that "there are just as good fish in the sea as ever came out of it" barely holds good of the North Sea. In the palmy days of the fishing-smack, sailing pretty much whither the wind listed, and consequently towing its trawl more or less at random, the shoals were given at least a sporting chance. Then came the steam-trawler, independent of wind and tide. A favourable patch of ground would be struck; over the side went a buoy, and round and round that blessed mark would steam the trawler, till every fish in the neighbourhood had been cleared off. The North Sea fishing-grounds are limited in extent, and the inevitable happened. Then the Iceland fisheries—discovered, so far as Grimsby was concerned, but little more than a score of years ago, by an enterprising shipowner who sailed north in a codman to investigate the reports brought back by long-voyaging boats of that class—were opened, and the North Sea was handed back, generally speaking, to the stay-at-home smack. In one respect, it should be mentioned, the proverb holds good: the North Sea fish still maintain their supremacy as regards quality, and consequently as regards price. But a trawler towing for six hours in the North Sea will catch less than its fellow on the Iceland grounds will often bring up in half an hour or less.

Of the voyage to Iceland and the crew aboard, interesting as were the incidents of the former and the personalities of the latter, it is unnecessary to treat in these pages. Let it suffice that after coaling at Hartlepool, and being detained a couple of days by stress of weather at Kirkwall, in the treeless Orkneys, we eventually sighted the glittering heights of Oräefa Jokull, the south-eastern point of Iceland. At Ingolf's Hof, an inlet at the foot of the mountain, good fishing is to be had, but our skipper on this occasion was bound for other grounds. Accordingly we kept on our course to Portland (the homely name of which sounds strange amidst the tongue-twisters of Icelandic nomenclature), on the southern coast, shooting our trawl in the vicinity of the Portland Blow Hole, an immense natural arch beaten by the waves in a protruding cliff, and a familiar landmark to all navigators of these waters.

Many readers are probably acquainted with the *modus operandi* of the trawler: at all events, the process is too difficult of detailed description to be attempted here. Briefly, the trawl—a wide-mouthed, tapering net, kept open by two heavy "doors," to which are attached the steel warps—is towed for a varying period of time over the bottom, at a distance of, say, 400 yards from the ship's stern. At the expiration of this period the steam-winch is set working, and the warps are hauled in until the aforesaid "doors" are pulled up on the derricks rigged fore and aft at the ship's side. It is at this stage of the proceedings that there occurs the first of what, to the present writer at all events, seem puzzling phenomena.

The business of hauling having ceased, and the mouth of the net in consequence brought alongside, a pause of a few moments ensues during which the skipper looks anxiously over the side. Presently a patch of water some fifty yards away assumes a light-greenish tinge, and amidst a swirling mass of air-bubbles the catch floats to the surface, the "cod-end"—or tail of the net enclosing the fish—being met, as it pops out of the water, by a fierce onslaught of countless gulls, eager for the sand-eels spewed up by the cod and haddock in their discomfort. Puzzler number one (to me) is to account for the mass of air-bubbles which accompanies the bag in its progress to the surface. I had better, perhaps, disarm criticism by observing, in the words of a famous phrase, that I am a child in these things, seeking to gain rather than impart instruction; but presumably the upward floating of the bag is due to the sudden transition of the fish, during the hauling process, from the depths to waters nearer the surface, and the consequent too rapid swelling of the air-bladder under the influence of the decreased pressure. This supposition, indeed, seems to be borne out by the fact that many of the luckless fish had the gullet protruding from the mouth, forced thither, I imagine, by the untimely behaviour of the bladder: but for the presence of so many air-bubbles in the water it seems difficult to account.

The second puzzler was the condition of most of the fish (I refer here to the cod and its kin), when the bag having been hoisted up on the tackles, and the knot at the end untied, they fell, flapping and feeble, on the deck. If picked up, still struggling, and thrown overboard, a cod or haddock—as a general rule—would float helplessly on the water, utterly unable to get below the surface, and would eventually expire in its own element. Such a course of action would seem the natural result of an unduly enlarged bladder, the creature having no means of voluntarily reducing the size of that organ; but—and here is the point—that same fish, if first stabbed in the belly with a knife before being thrown overboard, would then vanish into the deep like a streak of silver lightning. I must own to less knowledge of the structure of, say, a cod, than perhaps befits a contributor to these pages, but since it seems unlikely that the slight incision in the belly could affect the bladder, I can only suppose that in some manner the abdominal cavity becomes inflated, and until artificially relieved in the manner indicated, prevents the fish from sinking. Such an explanation — and I should be gratified if some better-informed reader would endorse or enlighten me — would possibly account also for the presence of the air-bubbles in the water already alluded to,—though it would hardly explain the also curious fact that in some waters the bag, when rising to the surface, will float slowly upwards until its end is just visible, while in others it comes with such a rush that it leaps out several feet above the level of the waves.

The various catches were never-failing sources of interest, and the contents of each bag were eagerly awaited. Off

Portland, haddock of a large and somewhat coarse size were principally taken. Cod and plaice were scarce. Halibut were not numerous, but much more so than later on in Faxe Bay. The last-named varied curiously in size, ranging from little fellows, no bigger than a small plaice, to monsters of ten stone or more in weight. One caught in the first few days of our fishing measured 6 feet from nose to tail (Mr Pycraft gives 20 feet as the "record"), with proportionate breadth and thickness. The larger halibut were noticeable for being "lousy," as the fishermen termed it,—infested, that is, with numerous moving parasites of a semi-transparent appearance. These four species, with an occasional strong-jawed blenny of the sea-cat variety ("cat-fish" the fishermen called them)—destined after submitting with a peculiarly ill grace to having its guts torn out, and being skinned on the pontoon at Grimsby, to appear on the retailer's slab as ling,—comprised the profitable part of the catch.

But the bag introduced us to many another sea-dweller: coal-fish, large, handsome, and frequent, but coarse and useless for the market; ling, welcome but occasional visitor; skate, with now and then an ugly monk-fish, eagerly pounced upon by the deck hands for the sake of his huge liver; and here and there a lump-sucker, or a dog-fish. The last-named were usually of the "spur-dog" variety, their dorsal fins armed with ugly spines, wherewith the creature, by a sudden twisting and doubling of its body, is able to inflict a nasty gash upon the hand that incautiously grasps it by the tail. A specimen of the "smooth-hound" which exhibited certain indications to the fisherman's experienced eye was cut open for my especial benefit, and some half-dozen embryo dog-fish—alive, wriggling, and almost perfect in form, save for a bladder-like attachment, not unlike the yolk of an egg, from which they were presumably deriving nourishment—disclosed.

For two glorious days (the climate of Iceland during the brief summer, which was then just commencing, is the true elixir of life) we lay fishing off Portland. But cod, which, being split and salted, and not like the other fish merely gutted and packed in ice, improves with keeping, and is consequently most welcome at the outset of a trip, was scarce, and the skipper determined to try his luck elsewhere. So we hauled in our gear, and steamed away along the southern coast to Reykjanes, the rocky and dangerous south-west promontory. Here two interesting objects were to be observed. The first was one of the famous hot springs of Iceland, its rising cloud of steam being plainly discernible in the clear atmosphere; and the other was the "Gannet Rock" (as the fishermen call it), a huge, bluff, and solid mass standing sheer and solitary in the deep waters, but connected, so the skipper told me, with the far-distant shore by a chain of submerged reefs. Snowy-white, in marked contrast to the burnt tints of the volcanic shore of the mainland, the rock looks at first sight like a transplanted chunk of Albion's chalk cliffs; but this aspect, as may be guessed, is due to the droppings of countless generations of countless myriads of gannets, puffins, gulls, petrels, and other sea-birds of the numerous varieties that followed in our wake or disported themselves, unconcerned, above and below the surface of the water in close proximity to the ship. One stands amazed at the thought of to what extraordinary depths the deposit of guano on this desolate rock must have reached by this time. Rounding Reykjanes, we made our way up the western coast to Faxe Bugt, a vast bay some sixty miles in width, with the great snow mountain of Snæfells Jokull keeping watch and ward at one extremity. On the shores of Faxe Bay lies Reykjavik, capital of Iceland, within distant sight of which we recommenced our fishing operations.

Some curious differences were to be noticed. Haddock were still very plentiful, but of a smaller size than at Portland. The fish of Faxe, however, is famed for its finer and more delicate quality, the bay being reckoned, indeed, the best although the farthest of the fishing-grounds. The plaice, for example, like the haddock, seemed here of a more refined variety, approaching very nearly, in freshness of appearance, to the much-sought North Sea fish. Halibut was almost entirely absent, and such few as were brought up were all of diminutive size, contrasting strangely with the giants of Portland. Cod was still scarce with us, this state of things remarkably illustrating the gregarious instincts of the species: for on one occasion, when the skipper had suspended work for a few hours to give the hands a much-needed rest, such a shoal invaded the waters as piled high the decks of every neighbouring trawler that happened to be towing at the time, yet vanished as suddenly as it had appeared when our nets were once more shot.

Frequent visits were paid to us, while in Faxe Bay, by crews of coast Icelanders. Hardy sons of the old Vikings are these shore-dwellers, with their high cheek-bones, fair hair, and keen blue eyes, buffeting the waves and enduring the bitter cold often enough for twenty-four hours and more at a stretch in their small open boats. To them the development of the Iceland fisheries has meant much. Formerly they wrested a bare living from the sea by fishing with lines for cod (as they still do when few trawlers are in the bay), and curing the hardly-won catch on the beach for sale to the store-keeper in the town, who, after getting the best of a hard bargain, exported the fish to Spain and other fish-eating countries. But since the advent of the steam trawlers the coast Icelander pursues a different course. Now he makes a tour of the different ships, and barters whisky or cigars, or even home manufactures such as slippers of seal or sheep-skin, for a load of small or useless fish, rejected by the skipper, but which he carries back to the curing grounds and turns to profitable account. English shipowners hear of this traffic with disapproval, fearing lest valuable fish be thus lost to them: but in most cases the alarm is unnecessary, while the fishing-grounds benefit by the removal of waste that would otherwise be flung overboard to rot on the bottom.

The visit of two whales to the bay, while we yet lay there, must not be forgotten. The day was fine, and the sea dead calm; and the astonishment of the writer may be imagined when, hearing a sudden snorting noise behind him, he turned and perceived, close to the ship's side, the great back of a whale slowly rolling over in the water. A similar apparition immediately followed the first, there being a pair of the monsters present. From what could be seen of them during the momentary glimpses afforded as they came to the surface, they should have been a couple of young pilot whales.

For some time they played in docile fashion round the ship, and then rolled off in search of fresh seas and waters new. A crew of Icelanders was setting sail for home alongside at the time, and it was curious to note the utter disregard with which they greeted the black leviathans as they rose to the surface, so close to the frail craft that any one of the crew could almost have touched the shiny backs with his hand. Familiarity indeed breeds contempt : for my part, small specimens of their kind though they were, they set me thinking. Whales, however, are not uncommon in Faxe Bay. The skipper told me he once saw a large one there, which had lost its way. Having strayed in through a chance deep-water entrance, it was unable to find a similar exit, being met, presumably, by sandbanks or other causes of comparatively shallow water, from the attempted passage of which the bulky frame shrank.

A week elapsed in Faxe Bay. The skipper was itching to be gone, and would long ago have signalled full speed ahead for home, but for the continued scarcity of cod. At length his heart's desire was granted. Suddenly, without warning, the waters were filled with cod. Bag after bag, in towings of twenty minutes and less, were hauled in, so full that the load had to be lightened alongside before it could safely be hoisted aboard. In a very short space of time the decks were choked fore and aft with the greenish fish, cod and codling, big and small, veterans and babes, till the deck-hands were wielding their gory knives waist-high in the slippery mass. In less than two hours I computed that something like 4000 fish must have been captured by the net.

With a smile on his face the skipper laid a hand on the telegraph, and the answering spurt of the screw churned the water in our wake to foam.

The Field Naturalist's Library.

REVIEWS OF BOOKS, PERIODICALS, ETC.

COMMON SPIDERS. By James H. Emerton. London: Ginn & Co. Price 6s. 6d. net.

This work is designed "to meet the wants of readers who, without making a special study of the subject, want to know a little about spiders in general, and especially those species that they often meet with." It ought also to "lessen the prejudice against spiders, and lead to a more general acquaintance with them, like the popular knowledge of birds and butterflies." Although primarily designed for American readers, field naturalists in this country will find this an admirable help in their studies, many of our species being described, and the general information given being to a large extent of universal application. But the striking feature of the book is the wealth and accuracy of illustration. Every species described is illustrated, and in such a way that its peculiarities are at once grasped. A large number are from photographs, which are excellently reproduced, the natural situations of the webs being well displayed. The Introduction deals with Silk and Spinning Organs, Colours and Markings, Habitats, Cobwebs, and the Catching and Preserving of Spiders,—precisely the things that the field worker wishes to be informed about. This is followed by a general description of each family, and that by the description of the species belonging to it, with a figure of each. The ground spiders and those without cobwebs are dealt with first, and the sedentary species living in webs in the latter half of the book. We heartily commend this book to field workers.

THE TREES OF NEW ENGLAND. By L. L. Dame and H. Brooks. London: Ginn & Co. Price 6s. 6d. net.

This is a concise account of the trees that are native in New England or established, as well as of foreign trees introduced. There are no less than 87 full-page plates in addition to the 196 pages of text, and all are well executed. A good plan has been adopted in reproducing the leaves, berries, &c., as much as possible of the natural size. The general plan of the work is to give first the description of the family, and then each species is dealt with under the following headings: Habitat and Range, Habit, Bark, Winter Buds and Leaves, Inflorescence, Fruit, Horticultural Value. The size of the book is well adapted for field work, as it fits easily in the pocket, and the book would form a clear guide in a woodland walk for such trees as are common to Old England and New.

EUROPEAN FUNGUS FLORA, AGARICACEÆ. By George Massee, F.L.S., Principal Assistant (Cryptogams), Royal Botanic Gardens, Kew. London: Duckworth & Co. Price 6s. Pp. 244.

Mr Massee in his dedication of this work says that it is an "attempt to introduce to British mycologists the Agarics of European countries." This is a very sweeping assertion to make about British mycologists, as they have for many years taken as their guide the master-work of Elias Fries, the 'Hymenomycetes Europæi,' dated 1874, and which is inaccurately cited in the Bibliography to this work as dated 1876; further, many have worked with Cooke and Quélet's 'Clavis Synoptica Hymenomycetum Europæorum' (1878), or Quélet's 'Enchiridion Fungorum' (1886), and have ultimately referred to Saccardo's 'Sylloge' and other works. Mr Massee's further remarks about the 'Hymenomycetes Europæi' are most amusing: "Although not of recent date, this work cannot be omitted, inasmuch as it embodies the experience of over fifty years of continuous observation on the part of the author, and is the sheet-anchor of the present generation of mycologists." Seeing that Fries described at first hand more than nine-tenths of the species enumerated in the present work, it is clear that Fries knew these species, which is more than we can credit the present compiler.

This work will undoubtedly be of great assistance to the English reader, and its moderate cost, 6s., should place it within the reach of all field workers. It is in the main a translation of foreign works, and we think it is a pity that the author has not kept it abreast of the times. We cite for examples *Tricholoma colossum* Fr., which Boudier proved many years ago was a true Armillaria, *Amanitopsis adnata* Worthington G. Smith, which equals *Amanita junquillea* Quél., and *Agaricus hæmatospermus* Bull, which is identical with *Inocybe echinata*, but which should now be considered a true Lepiota notwithstanding the colour of the spores, and should therefore be cited as *Lepiota hæmatosperma* (Bull) Boud.

English readers will regret that he has confined his attention to the European Agarics, as a comparison with those occurring in America would have been most interesting.

We note the addition to the spore groups Chlorosporeæ, which we believe the author first enunciated in the Kew 'Bulletin,' but at present it seems too restricted in its range, whilst the sinking of the Porphyrosporæ in the Melanosporæ will not, we venture to think, assist the student in his study of these orders.

Mr Massee has again gone taste-hunting in his rearrangement of the Lactarii, as he had previously done in his 'British Fungus Flora' for the Russulæ, with an addition to the colouration of the milk. Is this a point worth labouring and making of primary importance? Does not the famous Fries rightly sneer at Secretan for the wonderful perception of his nose, and do not the present mycologists have different palates, and so appreciate the mildness or acridity of a specimen to a different extent, and is not this feature also dependent on rapidity or slowness of growth, moist condition or dessication, the presence of larval excrement or the deposition of insects' eggs? It seems to us that widely separated species are thus brought into close proximity without any other character justifying such a position. *Lactarius tabidus* Fr., printed on p. 70, seems to have bothered Mr Massee as to which group he should assign it to. He there states; "Owing to absence of description of milk, position uncertain." We presume he was translating from the "sheet-anchor," 'Fr. Hym. Eurp.,' but had he consulted either 'Fr.

Icon.,' vol. ii. p. 71, or his 'Monographia,' vol. ii. p. 182, he would have found the fateful words "lacte albo submiti."

There are many omissions of species already described, and we jot down a few at random: *Nolanea incarnata* Quél., *Chitonia pequinii* Boud., *Russula amœna* Quél., *Lepiota submarasmioides* Speg., *Lepiota littoralis* Menier, *Lepiota arenicola* Menier, *Flammula rubicundula* Rea, *Lactarius porninsis* Roll., *Tricholoma saponaceum* var. *lavedana* Roll., *Omphalia bibula* Quél. var. *citricolor* Roll, *Lepiota lilacina* Quél., *Russula Raoulti* Quél., *Marasmius Delilei* De Seynes. Whilst *Mycena lasiosperma* Bres., p. 41 and p. 44, is ranged both under the Rigipedes and the Filipedes group.

Many species are recorded as British which it is hard to say where they have been previously recorded in British botanic literature, whereas, on the other hand, the bracket indicating not British could well be removed in some instances. We cite as examples of the last *Amanita junquillea* Quél., *A. porphyria* A. and S., *Tricholoma glaucocanum* Bres., *Mycena atromarginata* Fr., and *Collybia pulla* Schaeff, amongst very many others too numerous to quote.

This work enumerates, according to the preface, 2750 European species of Agarics, of which 1553 are therein declared to be British, and which Massee in his 'British Fungus Flora' enumerated at about 1452. Fries in his 'Hym. Europ.' enumerated some 1860. Thus we see the growth is somewhat alarming—the European has increased from the year 1874 by 890 and the British by 101.

FOWLS OF THE AIR. By W. Long. London: Ginn & Co. Price 7s. 6d.

Mr Long—whose 'Secrets of the Woods' we noticed in our last issue—dedicates this book and the next under notice "to the Teachers of America who are striving to make Nature Study more vital and attractive by revealing a vast realm of Nature outside the realm of Science, and a world of ideas above and beyond the world of facts." We would say at once that it would be well if all teachers in this country who have the same aims would make themselves familiar with the contents of these two books, which are admirably adapted for their purpose. But we fail to understand what Mr Long means by a vast realm of Nature outside that of Science; we know of no such realm, and if we thought that the ideas which Mr Long endeavours to inculcate were unscientific we should not hesitate to condemn them. But our author in these works is better than his dedication would indicate, and we regard both his methods and his ideas as truly scientific for the audience he is addressing. Our readers do not need to be told that anything which stimulates interest in Nature Study and helps to its more perfect teaching commands our hearty support; but we strongly hold that such study and teaching to be of any use must be, in the truest sense of the word, scientific. If there be still some weak-minded persons to whom the word "science" is anathema, by all means omit the word, but retain its essence and spirit in all teaching and learning, so that the result is still scientific even if unconsciously so.

The common names used in this book for the animals described are those given to them by the Milicete Indians, as the author explains. The occasional legends referred to in the text are not to be found in any writings, but are from Indian lore, heard by the author at the camp fire. The incidents and sketches are obviously true to life, and betoken an admirable power of keen and accurate observation on the part of the writer. Amongst the birds whose everyday life is here portrayed so delightfully are the Partridge, Eagle, Wild Duck, Oriole, Kingfisher, Woodpecker, Sheldrake, Big Brown Owl, and others. Mr Long's method of making his readers familiar with the daily round of these creatures must be read to be appreciated, and we are sure that those who do study the book will be astonished at the wealth of detail wrapped up in such simple language. If this is not scientific teaching we do not understand the term. It may not be *technical*, but technicality is not science.

BEASTS OF THE FIELD. By W. Long. London: Ginn & Co. Price 7s. 6d.

This book is on precisely the same lines as that last noticed, dealing with mammals instead of birds. There are ten full-page illustrations by Charles Copeland (the previous work has nine), but these appeal to us less than the numerous small sketches interspersed in the text on every page, often two or three on a page. These latter are very clever, and illustrate particular attitudes, habits, footsteps, homes, shadows, methods of feeding, &c.; all clever in conception and well executed. The illustrations in the chapter on "Fox-Ways" are a lesson in themselves, and the same applies to other series. The observations on the habits of the animals dealt with could only be the result of an abnormally vivid and prophetic imagination, or an equally unusual power of accurate observation. They are obviously due to the latter quality. In our opinion there can be only two results of the wonderful series of Nature Study books that Messrs Ginn are introducing to the British public. One is, that they will supply this country with all the books of this type about our indigenous animals as well as American; the other—and perhaps the more likely—is, that British authors and publishers will very soon, if they have not already done so, begin to write and issue similar works on strictly British subjects. In the meantime our American friends have got a long start of us in this matter, and it will take some time to overtake them. In this particular book Mr Long details his observations on the Squirrel, Caribou Deer, Rabbit, Otter, Bear, Weasel, Moose, Beaver, Lynx, Fox, and Wood-Mouse, at least half of which are as British as American. Field naturalists who would have a glimpse, and more than a glimpse, into the minds of these creatures should read this book.

DIVERSIONS OF A COUNTRY GENTLEMAN. By Sir George Douglas, Bart. London: Hodder & Stoughton. Price 6s. net.

Those who read in the 'Scotsman,' 'Glasgow Herald,' 'Outlook,' 'Field,' and 'Kensington' the delightful articles which are here gathered together into one volume, need not be reminded of their charm. It will be sufficient for them to have their attention drawn to the fact that they can now obtain the series in book form. Those who have not read these sketches of Border life may be assured that there is a treat in store for them when they do. Nothing but profuse quotation would give an adequate idea of the touching, quaint, yet amusing qualities and sayings of the last occupant of the "old House," but the author has succeeded in drawing a very lifelike picture of the Scottish lady of the old school. We like the two chapters devoted to the good Jacobite lady and her servants even more than the more sporting ones on the Salmon-Poacher, A Rural Coursing Match, A Motor Car on Border Roads, A Shepherd's Fox-Hunt, Salmon-Netting in the Upper Waters; but all are most delightful reading for an armchair and the fireside.

EARTH AND SKY. By J. H. Stickney. London: Ginn & Co. Price 1s. 6d.

This little book is No. II. (we have not seen No I.) of the 'Study and Story Nature Readers,' a second and third grade nature reader. The object of the series is "to bring before children's minds their own relation to the natural world in such a way as to appeal to the imagination and reflection." This is, of course, the only way to get a child interested in nature or anything else. The writer expects considerable intelligence from the teachers who use the book, but given this, the result cannot but be good. An intelligent parent reading these lessons to a child whose interest was aroused would teach in a way that would not be forgotten. The matter is so put forward that the child must inevitably ask questions—that is, the imagination and reflection are stimulated and roused.

THE EARLY LIFE OF THE YOUNG CUCKOO. By Percival Westell, M.B.O.U. London: H. Drane & Co. Price 1s.

A wise man once said that of the making of books there was no end, and after reading this one through twice in search of an adequate reason for its issue in book form, we fell back on the above quotation as a consolatory prophecy meant for those who dread the early exhaustion of British literary fuel. The first half is devoted by Mr Westell to telling what his friend Mr Craig has said and done in reference to the young cuckoo: the second half is largely a reiteration of the first. The facts stated and observed are valuable, but they are few, and when put in book form are quite out of perspective. They would have been in their place in the columns of a naturalist society's illustrated transactions. The four plates are from original photographs of great excellence and value, to which unfortunately—particularly in the fourth—the reproductions do not do justice.

THE LIFE OF A BEAN. By Mary Laing. London and Boston: D. C. Heath & Co. Price 6d.

A most delightful reader for children of seven or eight years of age.

It tells the life-history of a bean in terms of human life, and is entrancing from beginning to end. The plan is to let each part of the plant tell the child its relationship to sun, air, earth, and water. It leads to the complete knowledge of *one* thing, which in our opinion is sound nature teaching.

GLIMPSES OF NATURE FOR LITTLE FOLKS. By C. Griel. Boston and London: D. C. Heath & Co. Price 1s. 6d.

Another school-book on sound lines. The coloured pictures are very fine, and the line illustration is abundant. Scientific facts are presented in pleasant talk, and embrace the lives of bird, insect, plant, flower, fish, and fungus. This little book gives to the child a general education, to be in possession of which will go a long way towards an intelligent outlook on nature in manhood. We commend it to teachers and parents.

NATURE STUDY AND THE CHILD. By C. B. Scott, M.A. Boston and London; D. C. Heath & Co. Price 6s.

Teachers are very apt to take offence when preached at, and justly so, otherwise every faddist would mark their course and sign their orders. Many books on the above subject have preached at the teacher, but Mr Scott's work is free from all professional cant, and consists of communings with fellow-teachers on methods, materials, and aims of Nature Study, and its intrinsic value as a factor in the complete education of a man. The experience and evident ability of the author make his work respected.

The book consists of over 600 pages, and is divided into two parts,—the first devoted to aims and methods, the second to detailed outlines. After discussing a type of the vegetable and animal kingdom in the manner the author approves, the way is open to the discussion of what Nature Study is. Why and How should it be taught? What is its aim? The chapters on Principles determining Method are, in a book uniformly good, of outstanding merit. As an illustration of co-ordination of work we know nothing to equal the schemes for eight years' continuous school study. An earnest teacher with such a text-book in his hand need no longer worship the Saturday class fad, but begin to work out his own salvation, confident that the author has trodden the path before him as an experimenter, a practical teacher, and a man of scientific method and knowledge.

Field Clubs and Societies.

DURING the last few years quite a number of books have been written by field naturalists, some of them dealing with special branches of biology to which the authors have devoted particular attention, others to the local conditions of flora or fauna. Of this latter class is the excellent work on the Flora of Liverpool and District recently issued by the Liverpool Field Naturalists' Society, or at least by some of its members. The district treated of comprises that within a radius of fifteen miles of Liverpool Exchange, and also includes the Sandhills as far north as Southport. There must be a very large number of botanists within this area to whom the work will be a most useful one. The last edition was published by the same society in 1872, and was followed by three Appendices bringing it up to 1887. Since then many changes have occurred, necessitating the present new and up-to-date volume. This edition comprises the work of the Flora Committee of the Liverpool Field Club of 1893, of which the editor was a member. Also numerous new localities are recorded by him, chiefly for Wirral, since the date mentioned. The editor is Dr Theodore Green, the president of the Liverpool Naturalists' Field Club, and he has had the able assistance of Dr J. W. Ellis and Miss E. M. Wood in the illustrations. The former contributes the photographs of the local scenery, while Miss Wood (the botanical referee of the club) has added a large number of drawings of the flowers from nature. Both forms of illustration are excellently done, and will make the book useful over a much wider area than its title indicates. We congratulate Dr Theodore Green, his coadjutors, and the Liverpool Naturalists' Field Club, on the issue of such an attractive and useful volume. It is another example of the good work our field clubs are doing.

The British Mycological Society held their annual week's Fungus Foray in the Hereford district, on the invitation of the Woolhope Naturalists' Field Club. At a meeting of the members the Rev. W. L. W. Eyre, Hants, was unanimously elected president for the ensuing year. Professor Marshall Ward, F.R.S., was elected vice-president, and to the great satisfaction of the members Mr Carleton Rea was prevailed upon to once more assume the duties of secretary and treasurer. Mr Carleton Rea, if we recollect rightly, has served the society in these capacities for seven years, and he was desirous of giving up office, but the society were naturally very loath to part with his services, and he acceded to their wishes. During the week of the foray papers were read by Mr P. H. Biffin, M.A., on the "Life-History of *Acrospeira mirabilis*," and by Miss Annie Lorraine on a "Species of Stilbum." The week proved a very interesting one to the mycologists, whose next year's foray is to be held at Savernake Forest.

Just as we go to press we have received the Annual Transactions of the Natural History Society of Glasgow, which contains some very interesting matter, to which we shall refer in more detail in our next issue. We are glad to note that Mr Hugh Boyd Watt's important paper on the "Seals, Whales, and Dolphins of the Clyde Sea Area" has been issued also as a separate paper.

Correspondence.

Arbor Day.—"I have read with great interest the article on the establishment of an annual Arbor Day in England in your last issue, and, with all deference to Mr Haines, should like to express my opinion regarding some of his statements. It is quite true, as he says, that in some 'rural districts the councils have a perfect mania for lopping trees, and cutting severely back all the beautiful old hedges.' The reason is, of course, as the writer goes on to say, 'that tall hedges injure the crops, and roads are supposed to deteriorate because the hedges prevent moisture from drying off them.' I venture to hold that both these reasons are good ones, though Mr Haines would imply otherwise. Rural beauty is no doubt an excellent thing to encourage, but in these days those who have to make their living on the land must be strictly utilitarian. Has it ever occurred to Mr Haines to make a mental guess at the amount of nutriment in the ground used up by these same old trees and hedges? Taken over the whole country there must be thousands of acres of land which are used up in growing hedges alone. True, they provide shade, but we in this country suffer more from lack of warmth than from lack of moisture. The roads, too, suffer severely in out-of-the-way places where the high hedges are left to shade them, retaining the moisture after wet weather for a long time, and thus readily cutting up from traffic which would not affect them if dry. Personally, I am a lover of birds, and would gladly encourage the more uncommon ones, but one cannot have them without a host of destructive species, making it an impossibility to save a crop of strawberries, gooseberries, &c., without the expense of netting the fruit. By all means plant the churchyards, village greens, railway embankments, and any waste land, but the days of high road hedges and high hedges round crops have gone for good."—Parish Councillor.

"As you ask for expressions of opinion on the question of the establishment of an Arbor Day, I should like to add a few comments on Mr Haines' article in your last issue. The establishment of such an institution, somewhat after the manner of the American observance, seems, in idea, good; but, as the writer of the article says, the way is as yet by no means clear. To my mind it is beset with difficulties. Both as a member of public bodies and as a property owner, I fail to see that much can be done. Putting aside the no doubt unintentional impertinence of suggesting that a society shall dictate to either public bodies or private individuals, there is no doubt that there are many parts of many counties which might be planted with advantage to both the birds and the scenery; but the local conditions differ so widely in even adjacent areas that the utmost care will have to be exercised to avoid the influence of the sentimentalist and the faddist. A dweller in the outskirts of Lakeland is in a very different position, and possibly holds very different opinions, to a resident of the outskirts, say of

Birmingham or Leeds, or in a colliery district. In these latter, constant care would scarcely keep alive trees otherwise suitable.

"As to lopping trees, it is, as every one must know, necessary, unless the trees have almost unlimited room, and are away from street and road lamps. Until the irresponsible gunner is educated out of existence any rare bird is doomed. Witness the clergyman who gloried in killing a Hoopoe not long since, and the collector who sent a man into Norfolk to exterminate the Spoonbill (I think that was the species). Trees on a roadside are dangerous, especially so on a country road, unless planted well back on one of the 'broad lanes,' and here, as Mr Haines says, no doubt the lord of the manor would intervene, or the local authority, just as the owner of the foreshore rightly would do if the pebbles or sand were interfered with.

"The custom of Continental countries can hardly be applied in England. I know the rows of poplars which line the straight roads, and the fruit-trees in the hedges, and the handfuls of cherries, &c., gladly given for the asking in certain Continental countries. I know also the planting rule and some of the beautiful cemeteries, but there is a prejudice in England against the planting of what would make large trees in burial-places. It arises from a dislike, sentimental if you will, to the idea of a tree gaining its nourishment from the soil of a burying-ground. I know of a piece of ground, recently purchased for an extension to a cemetery, where some fine trees will have to be felled and the roots grubbed up for this reason, and feelings such as these must be respected.

"As to the local authorities being 'forced' (p. 169) to do anything, it is, as I say, an impertinence to suppose that any society could oblige either urban or rural councils to spend ratepayers' money on that society's objects. I would not advise a trial of strength on the point. Many others besides myself would like to have available ground in which to plant a tree each year, and so too would the assessment authorities, as in many instances it would appreciably raise the value of property.

"Public land cannot of course be alienated or even planted without public consent, and I doubt if any public body would care to ask the ratepayers to buy and plant trees on the public lands. These lands are in many cases a long distance from the town (be it small or large), and are, where possible, used for purposes of profit. I do not refer to ornamental parks or playgrounds, which are managed in a different manner.

"This is, as one man views the proposal, trees and troubles first, and birds afterwards. If Arbor Day is to come, it must come gradually, without pressure, without hysterics, and without a farthing on the rates."—S. L. Petty.

(Mr Haines in his article expressly said it would be only if an Arbor Day were established as a *national* observance (the word "national" was in italics) that the local authorities could or would be forced to carry it out. There was no mention of a *society* dictating or attempting to compel authorities. The idea is distinctly excluded in the emphasis on the word "national." There could be no "impertinence" in compelling persons to carry out a national wish,—it is done every day in all courts.—Ed.)

"I have long held the notion, imparted to me sometime in childhood, that the law of entail, in Scotland at least, compelled an entailed-estate owner to plant three trees for every one cut down. Perhaps some other reader of the F. N. Q. will confirm or dissipate this idea for me. The general trend of Mr Haines' article on Arbor Day in your last issue must, I think, appeal to every balanced mind, whether naturalist or not. The devastation of our hills, even from a commercial standpoint, is regrettable and imprudent, while from the æsthetic, sanitary, and economic views it is madness. A very apt quotation from 'Rodney Stone' contains a working suggestion. 'Collingwood took a little black bag out of his pocket and shook it. "What do you suppose I hold in this bag?" "Bullets," said Trowbridge. "Something that a sailor needs more than that," answered the admiral, and turning it over he tilted a pile of acorns on to his palm. "I carry them with me in my country walks, and where I see a fruitful nook I thrust one deep with the end of my cane."' "—Rusticus.

The Adder-Swallowing Question.—"Although I do not pretend to be an anatomist, I do read all that I can find on the vexed question of the adder mother and her young. Moreover, I have heard a good many lectures on the structure and development of these reptiles. I am utterly puzzled to know how it is possible for young adders 5 inches long to be found in "the ovary" of the mother, as stated in the 'Field' for August 30. Also, I always understood that there was no direct communication between the blood-vessels of the young and the mother. I should be glad if you would clear up these points in the F. N. Q., for myself and others whom I know are likewise puzzled to understand the article in question. I enclose my card."—"Ophis."

("Ophis" and other correspondents will find this matter dealt with in another page of this issue. He is perfectly right in saying that there is no direct communication between the blood-vessels of the embryo and those of the mother. The embryonic blood-vessels extend only into the yolk mass in the egg, not beyond the egg-membrane or shell, as the case may be. This is one of the arguments used by those who deny the possibility of the transmission of acquired characters in the parent to the offspring.—Ed. *F. N. Q.*)

Adders Swimming.—"Before it could be killed, an adder, 26⅛ inches long, swam 200 feet across the river Shin, near Inveron Bridge, Sutherlandshire.—'Daily Mail,' August 26, 1902.

"When I read the above I called to mind your remarks in the May number of the F. N. Q. (pp. 81, 82) on the question of whether the adder takes to water or not. I enclose the paragraph in case you have not seen it."—Ruth Smith, Hove, Sussex.

(The same statement from various papers was sent to us by correspondents, whom we beg to thank. From the instances which have this year been recorded in the F. N. Q. and in the 'Annals of Scottish Natural History' there can no longer be any doubt that in Scotland, at any rate, the adder habitually will enter the water. It is something to have added this point of definite knowledge in the life-history of this reptile.—Ed. *F. N. Q.*)

A Prolific Snake.—"Somewhere in 'British Serpents' it is stated that, considering how prolific the common ring snake is, it is surprising that more specimens are not encountered. The following paragraph from the 'Tasmanian Mail' shows how prolific too are some species not so harmless as our *T. natrix:* 'Mr Charles Butters ran down a big specimen of the Tasmanian black snake, and despatched it, and upon opening it found no less than 47 young ones, all very much alive.' Surely this is nearly a record."—J. H. L. O.

(We are not aware of any case in which a snake is recorded as having contained a larger number of developed young than this.—Ed. *F. N. Q.*)

Various.—"Mr Thomas Thompson, Windlaton, asks if weasels hunt moles in their runs. This has been frequently noticed—*e.g.*, in White's 'Selborne,' Letter LX., 'Weasels prey on moles, as appears by their being sometimes caught in mole-traps.'"—J. L. Bevir.

"Adders this year have not been seen nearly so often as is usual here. Last year, where we killed seven or eight in my hay-fields, we have not seen one in the present season, probably due to the lack of warm sunshine to bring them out. I notice in the last F. N. Q. that a correspondent asks if it is common to get weasels in mole-traps. I have trapped several in that way, always the smallest kind of weasel, never a stoat."—James Bartholomew, Kinnelhead, Beattock.

"The folk-lore name for the kite in the village of Castor in Northamptonshire is 'Swapmalekite.' An aged resident of the village spoke of the kite by this name. No kite is ever seen in this district now, but fifty or sixty years ago a kite might often be seen hovering over the poultry-yards, when the hens would cower down and cluck their chickens under their wings for protection. The first syllable of this extraordinary name is possibly a corruption of the word 'swoop,' expressive of the manner in which the bird descends upon its prey. The second syllable expresses the evil reputation of the bird as a robber of the 'chicken-pens.' In the villages of North Northamptonshire I have frequently heard it stated that a field-mouse cannot cross a field footpath without dying in the effort. Whatever may have been the origin of this strange belief, it is certain that dead bodies of field-mice are more frequently found on the footpaths than anywhere else. What is the explanation?"—W. H. Bernard Saunders.

"*Birds in Shakspere.*—Mr J. L. Bevir's most interesting papers on this subject in your Quarterly prompt me to make one or two remarks thereon, to supplement what he has said.

"First, as to *Estridges* ('2 Henry IV.,' iv. 1). Is it not generally admitted that by this term Shakspere meant not ostriches, but female goshawks? He certainly did so in another passage ('Ant. and Cleop.,' iii. 13. 197). The same bird is alluded to in a stage direction to 'All's Well,' v. 1, 'Enter a gentle astringer,' absurdly altered to 'Enter a gentleman.' The word (see Nares's Glossary) is derived from *austercus*, late Latin for 'goshawk.' Mr Bevir's reference to the word 'jerkin' in the 'Tempest,' as connoting the female gyrfalcon, is more interesting than convincing. I should doubt also whether Shakspere knew much about eagles at first hand. He appears to me to refer to them in a purely conventional way, as the stock-in-trade of all poets, or else to regard them only as a superlative sort of falcon. With falconry in all its branches Shakspere was undoubtedly familiar, but in every other department of bird knowledge his proficiency was very small. There are very few (if any) signs of personal observation, and his contemporary and fellow-countryman, Michael Drayton, can tell us much more about the Warwickshire and neighbouring fauna than Shakspere. Some common birds, such as the wagtail, are merely items in the poet's vocabulary of abuse; that common and striking bird, the kingfisher, only appears in the disguise of a halcyon hung head downwards to tell which way the wind blows; the blackbird is scarcely alluded to; and the goldfinch, bullfinch, linnet, woodpecker, and the tits never, unless the term 'tailor,' in '1 Henry IV.,' 3. 1, be a shorter form of 'proud tailor,' a local name for the goldfinch. But Shakspere does speak of the dabchick and robin by the local names of divedapper (= didopper, in Rutland) and ruddock; he has reminiscences of robbing a jay's nest; of nine wrens in a nest; and he knows that a lark and bunting (*i.e.*, the corn-bunting) are even more alike than a hawk and a harnsar; and that a cuckoo is specially fond of the hedge-sparrow as a foster-parent for her young, which young he calls 'that ungentle *gull*, the cuckoo's *bird*,' where *bird* means 'callow nestling.' His treatment of the nightingale and swan is wholly conventional. With him, as with almost all poets, it is the hen nightingale that sings, and sings only at night. The swan of course sings her death-song with him as with others.

"Only in one case, or possibly two cases, does Shakspere endeavour to give even a bar of bird's song in words. He certainly does so in respect of the thrush's or throstle's song in 'As You Like It,' ii. 5, 'Come hither, come hither, come hither,' a repetition of phrases eminently characteristic of the bird, and happily hit off by Tennyson in his poem, 'The Thrush,' with the words, 'I know it, I know it, I know it.' The nightingale's song, taken off in the 'Passionate Pilgrim,' is not from Shakspere's pen, but it runs prettily enough—

> 'Fie, fie, fie, now would she cry,
> Tereu, tereu, by and by.'

"Shakspere's favourite bird seems to have been the lark, which is associated in his emotions with all that is bright and joyous in nature and in human nature."—Reginald Haines.

"A fine specimen of the *Marsh Harrier* (Moor Buzzard) was trapped near Hereford in April 1902. It was only caught by one claw in a trap, but was incontinently knocked on the head by the keeper who found it."—Reginald Haines.

"The *Little Owl* (*Athene noctua*).—This bird, orignally introduced by Lord Lilford into the Midlands, is now quite common as a breeding species in Rutland."—Reginald Haines.

Freezing of Plants.—"I have just seen the first number of your new periodical, and observe in Mr Dutt's article on 'Marsh Botany in Winter' a reference to an article of mine in the 'Midland Naturalist' of 1879 on 'Hardiness in Plants,' with a suggestion that I should communicate more recent information. The best response I can make is to refer inquirers to Kerner's 'Natural History of Plants,' vol. i. p. 539, where the latest information will be found up to about 1890.

"At p. 75 of your Quarterly the common plant *Galeopsis Tetrahit* is spoken of as poisonous 'by contact.' If this means by stinging, is it true? I have gathered it many times without any such result."—F. T. Mott, Birsal Hill, Leicester.

(Mr Mott's letter was received just after the last number had gone to press.—Ed. *F. N. Q.*)

Answers to Correspondents.

Stable Pests.

We have received three species of beetles which were found infesting a hunting stable. These have been submitted to Mr Claude Morley, who reports on them as follows :—

"Undoubtedly all these have been introduced with corn, the foreign importation of which has brought us many pests from foreign lands unknown in the days of home growth, for none of these are natives of Britain. They are—

"*A.* 12. *Calandra granaria*, Linn.—This is *the* granary beetle *par excellence;* it has been for years a scourge to the garner of corn, and no insect does more damage to wheat, oats, rye, maize, flour, oilcake, but especially to barley and malt. I have, moreover, on one occasion found it abundantly in sugar. As long ago as 1687 Leuwenhoek published an account of its economy in the 'Encyclopédie Méthodique' (vol. v. p. 488), and during recent years Curtis, Ormerod, Fitch, &c., have closely studied its habits and brought forward many forms of prevention and remedy for its attacks. The female bores an oblique hole in a grain of wheat with her rostrum, and therein deposits one egg just beneath the surface, whence hatches a little maggot-like larva or caterpillar. This larva devours the whole interior of the grain, leaving nothing but the husk, and then changes in it into a dormant chrysalis. In eight or ten days this in turn becomes a perfect beetle, which gnaws its way to freedom through the empty husk-skin. Only one larva is ever found in a grain, the substance of which is just sufficient to support its larval appetite. The disintegration of the grain changes its colour and appearance in no way, so that often a great heap of grain is found to consist of nothing but the worthless husks. These bear the tell-tale hole whence the depredator has made his escape. The beetles require a temperature of more than 50° Fahr. to call forth their activity, which extends in Britain from April to September ; and it has been estimated that a single pair of April beetles will have produced a happy little family of 6045 descendants in the course of the five months. During the winter the beetles desert the corn-heaps and seek warmth and darkness in any crevices, holes, folds of sacking, &c., that may be at hand.

"*B.* 25. *Silvanus surinamensis*, Linn.—This is another destructive species which has become commonly naturalised in Britain, though its home is obvious. It has upon rare occasions been found beneath the bark of trees in the open country, but usually lies like the preceding in shops and granaries, possessing an even more omnivorous maw and doing much damage to bran, rice, various kinds of corn, dried figs, sugar, &c.

"*C.* 19. *Læmophlœus ferrugineus*, Steph.—This little red beetle pierces wheat grains in granaries and corn-bins with a hole as small as that made by a needle's point ; it is found most destructively in the East Indies, whence it was probably in the first instance imported. It is now quite naturalised with us, and I have several times found it beneath the bark of oak and holly trees, sometimes in small colonies ; it has also been found beneath that of elm.

"As to the best remedy for these stable pests, the simplest, most effective, and inexpensive for all grain insects is probably bisulphide of carbon, which has recently become of general application both here and in America. This is a colourless liquid with a strong and disagreeable smell ; it is said to vapourise abundantly at ordinary temperatures, to be highly inflammable, and a powerful poison. The most effective manner of application in moderately tight bins consists of simply pouring the liquid into shallow dishes or pans or on to pieces of cotton waste, and distributing these about the surface of the grain. The liquid rapidly volatilises, and being heavier than air, descends and permeates the grain-heap, killing all insects, as well as any rats or mice it may encounter. The bisulphide is usually applied in tight bins at the rate of 1 lb. or 1½ lb. to the ton of grain ; whilst in more open bins a larger quantity is of course necessary. Bins may be rendered practically air-tight by coverings of oilcloth, painted canvas, &c. The grain should be left under this treatment for twenty-four hours, but it will be in no way impaired if the period be extended to thirty-six hours. The main drawback to this plan is the poisonous nature of the agent. A thorough floor draught, with frequently whitewashed walls and clean floor, is as good a preventive as can be found."

J. L. M., Gloucester.

The passage you refer to, describing the effects on different species of plants and animals caused by the struggle for existence, occurs in chap. ii. of Wallace's 'Darwinism,' and is as follows: "Two of our common plants, the wild Heart's-ease (*Viola tricolor*) and the Red Clover (*Trifolium pratense*), are thus fertilised by humble-bees almost exclusively, and if these insects are prevented from visiting the flowers, they produce either no seeds at all or exceedingly few. Now it is known that field-mice destroy the combs and nests of humble-bees, and Colonel Newman, who has paid great attention to these insects, believes that more than two-thirds of all the humble-bees' nests in England are thus destroyed. But the number of mice depends a good deal on the number of cats; and the same observer says that near villages and towns he has found the nests of humble-bees more numerous than elsewhere, which he attributes to the number of cats that destroy the mice. Hence it follows that the abundance of red clover and wild heart's-ease in a district will depend on a good supply of cats to kill the mice, which would destroy and keep down the humble-bees, and prevent them from fertilising the flowers. A chain of connection has thus been found between such totally distinct organisms as flesh-eating mammalia and sweet-smelling flowers, the abundance or scarcity of the one closely corresponding to that of the other!"

C. R. G., Essex.

Only one species of Swift, *Cypselus apus*, is at all common in these Isles, one of the last summer visitors to arrive and earliest to depart, May and August being the periods of its migrations. The Needle-tailed Swift is a straggler from Siberia, and has been once recorded in Essex ('British Vertebrates,' Aflalo, p. 191).

SALOPIAN.

You will find an account of the mammals of Shropshire in Forrest's 'Fauna of Shropshire,' which may be obtained from L. Wilding, Castle Street, Shrewsbury.

T. N., Wilts.

Mr C. M. Rogers in 'Nature' (November 14, 1901) recorded the finding of mice inside the ring snake on two occasions; and also the finding of birds which this species had swallowed on three occasions. Some high authorities have restricted the diet of the ring snake (*T. natrix*) to fish and amphibians, but we were never able to understand the partiality of the snake for climbing bushes unless it had an eye to some young birds.

BUMPKIN.

See answer to "Ophis." Your letter savours too much of the style of the champions of the side opposed to your view for us to insert it. Are you really a bumpkin? We agree with your argument but dislike your mode of expressing it.

Young Naturalist's Quarterly Competition.

In order to encourage the study of natural history and other scientific subjects, the Editor offers prizes every quarter for the best essays sent to him on the prescribed subjects. The competitions are open to all young students and scholars, and are specially intended for the pupils of public schools, colleges, &c., which have natural history and other societies for their scholars. Competitors must send their essays in their own handwriting, together with a statement from their head-master or clergyman certifying the essay to be the original and unaided work of a competitor under nineteen years of age. Essays should not exceed 1000 words, but may be as short as desired. In awarding the prizes, the Editor, whose decision is final, will take into account both the accuracy of the matter and its arrangement. The result of the competitions will be announced in the following quarter's issue. The successful competitor must then select his or her prize from those offered, and inform the Editor at once where the prize is to be sent to.

The Editor reserves the right to publish any of the essays sent in.

Note.—The subject for the next quarterly competition is, "**How British Amphibians and Reptiles pass the Winter.**"

Competing essays (with statement of age and originality) must reach the Editor of the 'Field Naturalist's Quarterly,' 17 Hartington Place, Edinburgh, on or before December 31, 1902. Envelopes to be marked "Competition Essay." The prizes will be announced in the next issue of this journal. First prize, any three of following books. Other prizes may be given.

Types of British Animals (Aflalo).
British Vertebrates (Aflalo).
A Walk through Zoological Gardens (Aflalo).
A Year with Nature (Westell).
Fauna of Shropshire (Forrest).
British Serpents (Leighton).
The Country Month by Month (Owen and Boulger).
Norfolk Broads and Rivers (Davies).
Design in Nature's Story (Kidd).
One Thousand Objects for the Microscope (Cooke).
Animal Coloration (Beddard).
To-day with Nature (Robinson).
The Vivarium (Bateman).
&c., &c., &c.

The Prize for the best Essay on "How British Birds provide for their Young Ones" has been awarded to Margaret Groser (North London Collegiate School for Girls), to whom the prize offered will be sent on receipt of the title of the selected book.

Notices.

TO CONTRIBUTORS AND CORRESPONDENTS.

ALL articles and other communications (typewritten if possible) intended for publication, and all books, Transactions, papers, &c., for review or other notice, should be sent to the Editor, 'Field Naturalist's Quarterly,' 17 Hartington Place, Edinburgh.

Business communications should be addressed to the Manager at 45 George Street, Edinburgh.

Contributors are requested to write the department to which their communication refers (*e.g.*, Ornithology) on the envelope.

Every effort will be made to return unused communications where stamped addressed envelopes are enclosed for that purpose, but contributors are advised to keep copies of their MSS., as the Editor cannot undertake responsibility for their non-return. Photographs or other illustrations sent for publication must be original and the absolute property of the sender.

The full name and address of the sender must accompany every communication. Anonymous communications will not be noticed. Correspondence is invited on all matters of general interest which fall within the scope of work usually done by field clubs and kindred societies. Original observations on the habits of living animals and plants will be specially welcomed.

The 'Field Naturalist's Quarterly' will be issued in February, May, August, and November; and all communications for the ensuing issue should reach the Editor at least one month in advance.

TO SUBSCRIBERS.

The annual subscription to the 'Field Naturalist's Quarterly' is 10s. post free. Single issues 2s. 6d. each. Subscriptions, which may begin with any issue, should be sent to the Manager, 'Field Naturalist's Quarterly,' 45 George Street, Edinburgh.

The 'Field Naturalist's Quarterly' may be ordered direct from the publishers, Messrs Blackwood & Sons, or through any bookseller or newsagent.

Copies of Nos. 1, 2, and 3 of the 'Field Naturalist's Quarterly' can still be obtained by new subscribers who wish to have the volume complete.

Cases, in green art linen, for binding volume i. of the 'Field Naturalist's Quarterly,' may be obtained from the publishers, price 6d. (post free 7d.) The publishers are also prepared to bind volume i. in the above style at 9d. per copy (including postage 1s.)

The new feature of the 'Field Naturalist's Quarterly' mentioned in our editorial of this issue will be arranged as shown in the form on this page. These forms have been printed as separate sheets, and can be supplied to all clubs and naturalists who are willing to fill them up as species come under their attention. Application should be made to the Editor.

THE FIELD NATURALIST'S QUARTERLY.

RECORD OF SPECIES OBSERVED.

Species.	Common Name.	Locality.	Date.	Observer.

Compiled by..

From ....

TO ADVERTISERS.

Applications for terms and spaces to be sent to the Manager, 'Field Naturalist's Quarterly,' 45 George Street, Edinburgh.

Special terms for selected places, or a series of (changeable) advertisements.

The Editor begs to acknowledge the receipt of the following books, papers, &c. :—

Diversions of a Country Gentleman. By Sir George Douglas, Bart. London : Hodder & Stoughton. Price 6s.
Common Spiders. By James Emerton. London : Ginn & Co. Price 6s. 6d.
Trees of New England. By Dame and Brooks. London : Ginn & Co. Price 6s. 6d.
European Fungus Flora. By G. Massee. London : Duckworth & Co. Price 6s. net.
Earth and Sky. Part II. By J. H. Stickney. London : Ginn & Co. Price 1s. 6d.
Beasts of the Field. By W. J. Long. London : Ginn & Co. Price 7s. 6d.
Fowls of the Air. By W. J. Long. London : Ginn & Co. Price 7s. 6d.
Analytical Psychology. By L. Witmer. London : Ginn & Co. Price 7s.
Scientific German Reader. By G. T. Dippold. London : Ginn & Co. Price 4s.
Wissenschaftliche Vortrage. By Dubois-Raymond. (Edited by J. Gore.) London : Ginn & Co. Price 2s. 6d.
The Flora of the Liverpool District. Edited by C. Theodore Green, F.L.S. Liverpool : D. Marples & Co. Price 5s.

The Seals, Whales, and Dolphins of the Clyde Sea Area. By Hugh Boyd Watt. (Glas. Nat. Hist. Soc. Trans.)
The Avicultural Magazine—September, October, November.
Annual Report, Plymouth Museum and Art Gallery.
Yorkshire Weekly Post (four numbers).
Knowledge—September, October, November.
The Naturalist—September, October, November.
The Naturalists' Journal—September, October, November.

INDEX.

The detailed references to each subject will be found under the various sectional headings— e.g., *Ornithology, Archæology, Reptilia, Correspondence, &c.*

The Titles of articles will be found at the beginning of the volume under "Contents."

Answers to Correspondents.

Adders, 155; Curious fungus, 155; Telegony, 155-156; Slow-worms, 240; Parr, 240; Cross-fertilisation, 241; Tawny Owl, 241; Nuthatch, 241; Mammalian tusks, 241; Stable pests, 330-331; Struggle for Existence, 332; Swifts, 332; Shropshire mammals, 332; Food of ring snake, 332.

Archæology.

NORMAN ARCHITECTURE—
  I., 143-147.
  II., 226-229.
  III., 301-307.
  Adel Church, 145.
  Buttresses, 147.
  Capital, 303.
  Ceilings, 147.
  Chancel, 146, 229.
  Characteristics, 302.
  Durham, 145.
  Ely, 147.
  Font, 304.
  Garway, 229.
  Kilpeck, 228.
  Lincoln, 144.
  Mouldings, 147.
  Ornaments, 147, 301.
  Peterborough, 144.
  Plan, 304.
  Porches, 227.
  Towers, 145, 305, 306.
  Transition, 147.
  Walls, 147.
  Windows, 146.
  Zigzag, 229, 306, 307.

Botany.

Agricultural Botany, 234.
Arbor Day, 165-171, 325, 326, 327.
Autumn Wild Flowers, 269-272.
Bladderworts, 131.
Buckbean, 59.
Cardamine pratensis, 127.
  " amara, 127.
Cnicus palustris, 59.
Colour in Winter, 56.
Cotula coronopifolia, 300, 301.
Dates of Flowering, 42-44, 119-122.
Drosera rotundifolia, 221.
Epipactis palustris, 128.
Ferns, 130.
Fertilisation, 129.
Galium palustre, 56.
  " uliginosum, 56.
Heredity, 163.
Hottonia palustris, 56.
Lathyrus palustris, 130.
Lemna minor, 57.
  " polyrrhiza, 57.
  " trisulca, 57.
  " arrhiza, 57.
Marigold, 59, 127.
Marsh Botany, 55-59, 126-132.
Menyanthes trifoliata, 129.
Orchis (varieties), 128.
Poisonous plants, 75, 330.
Potentilla, 130.
Resistance to frost, 58, 330.
Scabiosa succisa, 56.
Stratiotes aloides, 57.
Taraxacum palustre, 127.
Toothwort, 307.
Utricularia, 57.
Valeriana dioica, 127.

Vegetable Galls, 70.
Water plants, 57, 130.

Competitions, 76, 156, 241, 333.

Correspondence.

Adder swallowing, 75, 76, 154, 327; Adders in water, 152, 153, 327; Ring snake, 153; Entomostraca, 154; Newts, 155; Butterfly at sea, 239; Weasels hunting moles, 239, 328; Boulders of Norfolk, 239; Arbor Day, 325, 326, 327; A prolific snake, 328; Folk-lore, 328; Birds in Shakspere, 329; Marsh Harrier, 330; The Little Owl, 330; Freezing of Plants, 330.

Editorials.

Foreword, 1-3; Animal Sense Perceptions, 4; Professor Cossar Ewart's Experiments, 5; Vertebrate blood research, 6; Objects of Field Clubs, 79-81; Adder and water, 81; Bird migration, 82, 83; Nature Study in Schools, 159-163; Heredity, 163; Bird Protection, 165; The necessity of studying scientific principles in Field Clubs, 245-247; A new feature, 248; Nature Study Exhibit in Edinburgh, 249-250.

Entomology.

Books on, 289.
Bot flies, 110.
Cabbage butterfly, 110.
Caterpillars, 109.
Chrysalis, 109.
Classification, 287, 288.
Cocoons, 109.
Eggs, 39.
Haunts, 108.
Hemimetabolous, 109.
Homometabolous, 109.
How destroyed, 110, 330, 331.
Leather beetle, 110.
Lepidoptera—
  Alps, 84-98.
  At sea, 238, 239.
  Extinct, 294-299.
  Handbook, 334.
Mayflies, 196-199.
Musk beetle, 205.
Number of species, 108.
Puss moth, 110.
Seasonal studies—
  Autumn, 285-289.
  Spring, 107-110.
  Summer, 202-205.
  Winter, 38-41.
Stable pests, 330, 331.
Turnip flea, 110.
Wasp, 110.
Where to search, 40, 285, 286.

Field Clubs and Societies.

Chester Soc. of Nat. Science, 72; Hastings and St Leonards Nat. Hist. Soc., 72; Uppingham Nat. Hist. Soc., 73; Heaton Chapel Lit. and Phil. Soc., 74; Caradoc and Severn Valley Field Club, 74; Essex Field Club, 150; Hampstead Sci. Soc., 151; Woolhope Naturalists' Field Club, 151; Norfolk and Norwich Nat. Soc., 151; North Staffordshire Field Club, 237; Wellington College Nat. Sci. Soc., 237; Epsom College Nat. Hist. Soc., 238; Northumberland Coast Club, 238; Liverpool Field Nat. Soc., 323; British Mycological Soc., 324; Glasgow Nat. Hist. Soc., 324.

Fish.

Age and sex signs, 182-185.
Angler fish, 8, 185.
Ballard, 183.
Black pilot, 7.
Bream, 183, 294.
Chad, 183.
Chimæra, 9.
Chinese methods, 258-260.
Claspers, 11.
Colours, 184.
Conger eel, 184.
Coral fish, 7.
Derbio, 7.
Dragonet, 184.
Eels, 240.
Elvers, 240.
Fish notes, 291.
Fry, 183.
Grilse, 184, 240.
Iceland, 310-317.
Jack, 183.
Lake fish, 294.
Lesser weever, 12.
Lophius piscatorius, 8, 9, 185.
Lumpsucker, 184.
Migrations, 99, 292, 293.
Monk fish, 10.
Monsters, 291.
Movements, 99-102.
Norway bullhead, 7.
Parasites, 186.
Parr, 183, 240.
Pike, 116, 183.
Purses, 11.
Rabbit fish, 9.
Rays, 11.
Salmon, 240.

Saw fish, 292.
Scales, 183.
Sea bass, 291, 292.
Short sunfish. 13.
Skates, 185.
Smolt, 240.
Torpedo, 11.
Trout, 294.
Uncommon fish, 7-13.
Weights, 11, 13, 291.

Folk-lore.

Shagfoals, 255-258.
Various, 328.

Fungi.

Acrospeira mirabilis, 324.
Agarics, 123.
Books on, 149, 150, 318.
Morels, 123.
Number of species, 122.
Peziza ochracea, 155.
Plant parasites, 125.
Spring fungi, 122-126.
Stilbum, 324.

Illustrations.

Merciless yet Merciful, *Frontispiece.*
The Angler Fish, 8.
Partridges, 79.
Death's Head Moth, 110.
Convolvulus Hawk Moth, 110.
Larva of Puss Moth, 110.
Puss Moth, 110.
Small Tortoiseshell Butterfly, 110.
Nest and Eggs of Lapwing, 134.
Nest and Eggs of Moorhen, 134.
A Promise of October, 159.
Stag Beetle, 188.
Nest of Montagu's Harrier, 188.
Buff Ermine Moths, 188.
Larva of S. Ligustri, 188.
Gulls of Twigmore Warren, 200.
Deep-Sea Plunder, 245.
Chinese Fishing Methods, 258, 260.
Capacity of Adder's Gullet, 268.
Slow-worm and Young, 290.

Mammals.

Books on, 148, 230, 231, 321.
Dogs, 59-65, 155.
Dormouse, 23-25.
Elephant, 241.
Moles, 111-114, 239, 328.
New Zealand, 45.
Photography, 138-143.
Rabbits, 202.
Study of, 251-254.

Molluscs.

Snails in Winter, 25-35.

Ornithology.

Barriers to spread, 45.
Birds in Shakspear, 132-137, 214-220, 278-284, 328, 329.
Bird song, 14-17, 73.
Books on, 233, 234, 236, 320, 322.
Coots, 49-51.
Corvidæ, 277-284.
Dates of arrival, 189-196.
Dispersal, 45.
Feathers, 171-177.
Gulls, 199-202.
Little owl, 330.
Marsh Harrier, 329.
Migrations, 82, 83.
Moa, 45.
Montagu's Harrier, 186-189.
Nesting, 171, 236, 325.
New Zealand, 45.
Norfolk Broads—
  Autumn, 272-278.
  Spring, 114-119.
  Summer, 205-213.
  Winter, 47-52.
Owl, 241.
Plover, 118.
Protection Act, 151, 166.
Raptores, 214.
Red-shank, 116.
Reeves, 118.
Ruff, 118.
Shropshire, 53, 54.
Spring birds, 119-122.
Starling, 272.
Swallow, 272, 273.
Swift, 45, 332.
Teal, 117.
Uppingham, 73.
Warblers, 273.
Wigeon, 116.
Wild duck, 274, 275.
Wildfowl, 293.
Wood-pigeon, 53.
Yellow wagtail, 115.

Reptilia.

Adder—
  Birth, 180, 181.
  Black variety, 155.
  Capacity of gullet, 266-269.
  Character, 17-19.
  Colour, 153, 267, 268.
  Food, 19.
  In water, 4, 81, 82, 152, 153, 327.
  Sex distinction, 18.
  Swallowing young, 75, 76, 154, 261, 266, 268, 327.
Age, 104.
Æstivation, 22.
Books on, 148.

Eggs, 106, 178, 179.
Eye-scale, 106.
Hibernation, 20-23, 105.
Lacerta vivipara, 104, 182.
Oviparous, 106, 177, 178.
Ovo-viviparous, 106, 177, 178.
Pairing, 106.
Reproduction, 177-182.
Ring snake—
  Birth, 180.
  Character, 18, 19.
  Eggs, 179.
  Food, 105, 153, 332.
  Incubating, 179.
  Movements, 18.
  Odour, 19.
  Timidity, 18.
Sand lizard, 178, 180.
Scotland, 121.
Season effects, 104, 328.
Sex, 104.
Shropshire, 54.
Sloughing, 105, 106.
Slow-worm, 105, 181, 289.
Smooth snake, 178, 182.
Sphenodon, 46.
Spring habits, 103-106.
Summer habits, 177-182.
Winter habits, 21, 22.

Reviews of Books, 69-72, 148-150, 230-237, 318-323.

END OF THE FIRST VOLUME.

PRINTED BY WILLIAM BLACKWOOD AND SONS.

3 2044 106 259 146